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Using Compressed Air for Cleaning Purposes

Explaining How Walls, Ceilings, Windows, Shafting, Electric Motors, Generators, Transformers, Machine Tools, Patterns, Core Boxes, Benches, etc., Can be Quickly Cleaned by Compressed Air

By F. A. McLEAN

THERE are many places in the modern machine shop and industrial plant where compressed air can be appled to considerable advantage for such work as cleaning walls, ceilings, windows, shafting, electric motors, generators, transformers, machine tools, patterns, core boxes work benches etc., as well as for blowing scale from steam hammers, stamping dies, drop presses, etc. One blast of compressed air, properly directed, will instantly clean the cuttings from a bored or drilled hole that would require the expenditure of many minutes' time by the old method of fishing them out with a magnetized file, or a piece of wire, and at the same time the lathe, milling machine, boring mill, or drill press, can be kept entirely free from chips and dirt without the necessity of using a brush or pieces of cotton waste. The equipment is simple and easily installed, and it is usually found that its first cost is quickly absorbed by the reduction in fire hazards and the added convenience and increased efficiency of the plant as a whole.

Most metal working concerns now use electrcity extensively, some operating their own plants, and others using power obtained from central stations or Hydro-electric plants, and it is often found that the motors become clogged up with dust and dirt, causing them to heat up through the reduction of the openings provided by the manufacturer for ventilating purposes, and increasing the liability of burned out coils should they be overloaded at any time, as the additional heat cannot be readily dissipated. Sometimes the motor bearings are oiled too much and the surplus oil gets into the windings, and combines with the dust and dirt to form a mixture whch readily absorbs moisture and shortens the life of the insulation, causing short circuits or grounds to the frame.

While all motors should be cleaned frequently, those installed in foundries and pattern shops, or in places where dust and moisture is always present, should receive more careful attention. Unfortunately, cleaning by hand is often exceedingly difficult, as the ventilation openings are usually too small to admit a brush, and the motors themselves are sometimes located on ceilings or in such cramped places where space in the building is at a premium, that it is almost impossible to get at them without a lot of trouble and inconvenience.

Under such conditions, the air jet has many features which make it of con-

PORTABLE MOTOR-DRIVEN COMPRESSOR OUTFIT.

siderable value for this work. In shops where a stationary compressed air power plant is not already in use for operating air hoists, pneumatic tools, sand rammers, etc., a small compressor of the portable, or semi-portable type for belt or electric drive, with a capacity of 3 to 45 cubic feet of free air per minute, at a pressure of 100 pounds per square inch and a receiver holding from 50 to 150 cubic feet, (depending on the amount and frequency of the cleaning to be done), can be purchased at a reasonable price. Where a stationary compressor is already in use it will usually be more convenient to pipe the air about the plant, making suitable openings for hose connections in the various departments where the cleaning is to be done; although in the case of large plants it is sometimes a good plan to use a portable outfit as well. In large plants where there are a considerable number of motors in use, it is a good idea to number them consecutively by means of small brass tags attached to the frames, or by painting the number on the casing. These numbers should then be entered on cards on which a complete record is kept of the date each motor was inspected and cleaned, when it was repaired, and any other information which may seem desirable.

For blowing out motors and generators, cleaning machine tools, or blowing chips from drilled or bored holes, a nozzle of the blow gun type is the most suitable. The blow gun consists of a solid casting with a metal to metal valve seat, and having no springs, gaskets, or other delicate parts, it is durable, foolproof and not liable to leak. It is shaped in such a way as to lend itself to convenient handling, and the long lever makes it easy to operate, and the short lift ensures prompt closing of the valve when released.

These valves are obtainable with either metal or fibre nozzles of any desired length, the former being suitable for use around machine tools, or general use, while the later is designed for use on electrical machinery. The principal advantage of this type of valve is, that it does away with the necessity of kinking the hose to stop the flow of air, and operates considerably faster than the ordinary globe valve, with consequent saving in air consumption. In addition to the blow gun it is also possible to buy several styles of self-closing nozzles of more elaborate construction, which work on a somewhat similar principle.

After a motor or generator has been thoroughly blown out it is a good practice to spray the winding with a high grade of air drying varnish, at intervals of six months or a year, depending on

CLEANING A D.C. MOTOR WITH AN AIR JET.

the conditions under which the machine is forced to operate. Before putting on the varnish, which should be applied by a compressed air plant sprayer, it will be found preferable to thoroughly clean the windings with gasoline applied with the paint sprayer, or with a double-barrelled or atomizing nozzle. There are a number of different sizes and styles of paint spraying outfits on the market, and as they can often be used for finishing parts of the product as well as on many other painting jobs around the plant in addition to this work, they usually pay for themselves within a very short time, as the following examples tend to show: From tests made by a large stove manufacturer, it was found that one man with an air brush could paint 100 standard kitchen ranges with air-drying enamel while 30 or 40 were being done by hand. In an electrical equipment factory, a single air brush operator lacquers 3,000 electric light sockets per day, instead of 500 or 600 by hand. With 10 air brushes a maker of brass bedsteads finishes 400 beds daily. An expert hand-painter will enamel from 150 to 200 lamp shades in a day, while, with an air brush, an average workman will turn out from 800 to 1,000 pieces per day.

The outfit illustrated in figure 5 is known as the "Spraco" and has proved very satisfactory in the service of the N.Y.N.H. & H.R.R. for spraying electrical machinery, as well as painting with cold water paints, etc.

The grade and composition of the varnish to be used will depend on whether the motor operates under normal conditions, or is exposed to chemical fumes of either an acid or an alkaline nature. In any case it is best to get in touch with the manufacturer of the motor, giving him an idea of the conditions under which it is used, and then rely on his recommendations in this respect.

For cleaning motors mounted overhead, ceilings, shaftings, pieces of brass or iron tubing as long as required, may be attached to the blow gun, and since the volume of the air required is not great, the tubing should be of small diameter for ease in handling and economy in air consumption. The end of the tubing may be bent to any desired shape which experience shows to be best suited for a particular purpose. When surfaces of considerable area, such as walls, ceilings, windows, etc, are to be cleaned, a suitable nozzle may be made by bending three or four inches of the tubing at right angles and plugging the open end after a number of small holes have been drilled in the short leg of the ell to form an "air brush." Before using a nozzle of this type, the air pipes should be blown out before attaching the hose in order to prevent dirt or scale in the pipes from clogging the small holes. Nozzles of this style may often be advantageously applied to certain types of annealing and hardening furnace doors, where the men in attendance are exposed to intense heat each time it is necessary to inspect the interior of the furnace. The nozzles are usually placed below the furnace door in such a way that the streams of air rising upward form an air curtain or screen, which effectively protects the operators against the intense heat and prevents the escape of flames each time the door is opened. When used for this purpose the air jet is superior to both water-cooled doors, which only afford protection as long as they are closed, and to exhaust blowers, which subject the workmen to too sudden changes of temperature.

One of the advantages which the air jet has over practically all other methods of cleaning, and which makes it of particular value to a manufacturing concern, is its ability to dislodge dirt and dust while machinery is running, thus keeping the machinery clean, while in no way interfering with its rate of production. While this feature is of considerable value in the metal working plant, it is of even greater importance in some industries, such as textile and paper mills, where the machinery is generally operated 24 hours a day and a few minutes' shutdown every few hours in order to clean the machinery, results in a material reduction in the output per day.

The air pressure required will depend on the nature of the work to be done, 10 to 35 pounds being suitable for blowing light particles or painting motors, etc., while for heavy, oil-laden dust and dirt, pressures of 60 to 100 pounds are more effective. Cleaning is accomplished by the sharp impact of the air upon the material to be removed, and with a suitable pressure this is accomplished as effectively with a small jet as with one of larger diameter. Nothing will be gained by using a large volume of air when a small one will do, as a heavy blast may scatter the dirt instead of merely dislodging it. When cleaning machinery it is advisable to start at the top of the machine and work downward, thus avoiding the necessity of going over any part a second time. It will sometimes be found necessary to instruct the operator how to manipulate the nozzle to the best advantage, so as to avoid blowing the dirt into the bearings of the machine. Should this trouble occur, it may be overcome by employing a lower air pressure. In attaching an air-cleaning nozzle over a machine permanently, care should be taken to suspend it in such a manner that it will not be in the operator's way. It is often possible to hang the hose from a point overhead and toward the rear of the machine, so that it will fall back out of the way when released. The hose should be long enough to reach to the lowest part of the machine to be cleaned, and as it is subjected to considerable wear, it is best to use either the wire wound or armored type, in the 3-8 of an inch size, as this is amply large for most cleaning purposes and is very easily handled.

It sometimes happens that employees who have not been properly instructed, remove the cleaning nozzles, thinking that they will be able to do better cleaning. Others will enlarge the opening in the nozzle by filing, with consequent increase in the air consumption, as may be readily understood by reference to the accompanying table. These troubles may be prevented by placing a reducer in the air supply line, or inserting a hardened steel bushing in the tip of the nozzle. The most effective way of combating these abuses, however, is to instruct the operators carefully and then see that these instructions are carried out.

The air as taken from the ordinary receiver is usually in satisfactory condition for ordinary cleaning purposes. Where some of the older types of com-

A CLEANING NOZZLE OF THE BLOW GUN TYPE.

too copiously in the air cylinder, resulting in small particles of oil being blown from the nozzle. For ordinary cleaning around the shop this is not objectionable, but for use on fine work, or when cleaning surfaces which are to be painted or varnished, and in textile and paper mills, it is necessary to have the air absolutely free from oil. An oil separator placed in the supply line will remove practically all of this oil, and when it is desirable to thoroughly clean the air, it may be passed through muslin or other light cotton cloths as well.

When cleaning motors before varnishing, and on some other classes of machinery, it is best to use a double-barrelled nozzle, the upper tube of which is connected to the air supply, and the lower by a piece of flexible tubing to a tank containing gasoline, oakite, or some other form of cleaning solution, thus effectively cleaning parts of a machine which could not otherwise be properly cleaned by either method alone.

In factories operating on steam power, compressed air may be readily used for blowing soot and dirt from the boiler flues, etc., for which purpose it will be found much more convenient than steam. The necessity of keeping the heating surfaces of the boiler free from soot is of especial importance when the present high cost of fuel is taken into consideration, as a layer of soot 1-32 of an inch in thickness will reduce the efficiency about 9½ per cent., while, if this accumulation reaches a depth of as much as ¼ inch, the reduction in efficiency will be 80 per cent. or more. When steam is used for cleaning the boilers the water of condensation is usually an objectionable feature, and it is necessary to use heat-proof hose, or insulate the nozzle in some way, so that the operator will have no difficulty in holding it. The ease with which an air hose may be handled, and the absence of moisture in the jet, makes the job much cleaner, and as it facilitates quick work, the men responsible for the care of the boilers feel more inclined to clean them frequently, with consequent increase in the amount of steam produced from each pound of coal consumed.

"SPRACO" PNEUMATIC PAINT SPRAYING OUTFIT.

When at first glance the cost of installing a pneumatic cleaning system may seem unwarranted, this is, however, not the case, as the correct basis for figuring the relative cost and value of the equipment should be the saving that can be effected by its use rather than the actual amount of money involved in its installation and maintenance.

The increase in production which results from the ability to keep the machinery in the plant thoroughly cleaned while it is in operation, will often pay the cost of supplying the air, and at the same time pay a good rate of return on the money invested in the necessary equipment. In many plants where compressed air cleaning systems have been installed, new uses for the equipment have been discovered, which were not thought of at the time the installation was made, and larger outfits have been purchased, as a result of the good service rendered by the smaller units. The greatest benefit to be derived from the use of compressed air as a cleaning agent in the shop, however, probably lies in the fact that through its use it is possible to maintain a clean shop and contented, healthy workmen.

FLOW OF AIR FROM A RESERVOIR THROUGH AN ORIFICE

IN CUBIC FEET OF FREE AIR PER MINUTE FOR VARYING DIAMETERS OF ORIFICE AND GAUGE PRESSURES

Diameter of Orifice Inches.	Receiver Gauge Pressure.								
	2 lbs.	5 lbs.	10 lbs.	15 lbs.	20 lbs.	25 lbs.	30 lbs.	35 lbs.	40 lbs.
1/64	.038	.0597	.0842	.103	.119	.133	.156	.173	.19
1/32	.153	.242	.342	.413	.485	.54	.632	.71	.77
1/16	.647	.965	1.36	1.67	1.93	2.16	2.52	2 80	3.07
⅛	2.435	3.86	5.45	6.65	7.7	8.6	10.	11.2	12.27
¼	9.74	.15.40	21.8	26.70	30.8	34.5	40.	44.7	49 09
⅜	21.95	34.60	49.	60.	69.	77.	90.	100.	110.45
½	39.00	61 60	87.	107.	123.	138.	161.	179.	196.35
⅝	61.00	96.50	136.	167.	193.	216.	252.	280	306.80
¾	87.60	133.	196.	240.	277.	310.	362.	400.	441.79
⅞	119.50	189.	267.	326.	378.	422.	493.	550.	601.32
1	156.	247.	350.	427.	494.	550.	645.	715.	785.40
1¼	242.	384.	543.	665.	770.	860.	1000.		
1½	350.	550.	780.	960.					
2	625.	985.							

Diameter of Orifice Inches.	45 lbs.	50 lbs.	60 lbs.	70 lbs.	80 lbs.	90 lbs.	100 lbs.	125 lbs.
1/64	.208	.225	.26	.295	.33	.364	.40	..486
1/32	.843	.914	1.05	1.19	1.33	1.47	1.61	1.97
1/16	3 36	3.64	4.2	4 76	5.32	5.87	6.45	7.85
⅛	13.4	14.50	16 8	19.0	21.2	23.50	.25.8	31.4
¼	53 8	58.2	67.	76.	85.	94.	103.	125.
⅜	121.	130.	151.	171.	191.	211.	231.	282.
½	215.	232.	268.	304.	340.	376.	412.	502.
⅝	336.	364.	420.	476.	532.	587.	645.	785.
¾	482.	522.	604.	685.	765.	843.	925.	
⅞	658.	710.	622.	930.	1004.			
1	860.	930.						

TABLE SHOWING FLOW OF AIR.

Our readers should be by this time quite familiar with the use of compressde air for the actual operation of painting. A writer in a recent issue of "Factory" calls attention to another important use of air in large paint shops.

Nearly all large plants, he says, have paint rooms of their own. Here is stored the paint supply of the whole factory. Because of the tendency of the paint to settle, it must be stirred up each time any quantity is withdrawn. As a rule, the stirring of paints by hand is done to the accompaniment of aching muscles and breaking backs. One good-sized factory, however, performs the whole operation by the turn of an air-cock. There happens to be a high-pressure air supply handy to the paint room. Paint is kept in barrels each containing a double wooden paddle. When the paint requires stirring, a pneumatic reaming tool is slipped over the end of the paddle shaft which projects above the barrel top. This shaft is held in place by two crossed pieces placed across the barrel head. By using the shaft in place of a reamer shank, the paddle is whirled rapidly and the paint mixed in a surprisingly short time. After one barrel of paint is mixed thoroughly the reaming tool is slipped over the paddle shaft in the next barrel. Thus the whole job is done quickly and with little labor.

There are nearly 35,000 fewer horses in service in New York City than there were two years ago, a reduction of more than 30 per cent.

The Use of the Pyrometer in Steel Industry*

A Continuation of a Paper Discussing the Progress Made in the Accurate Measurement and Control of High Temperatures in the Heat Treatment of Steel of All Kinds

By R. P. BROWN

A GALVANOMETER indicates the point at which no current is flowing, and when the pointer on the galvanometer indicates zero, the voltage of the dry cell equals that of the thermocouple. The line resistance from the dry cell to the galvanometer is exceedingly small and constant. When the thermocouple voltage has been opposed to the voltage of the dry cell and balanced, the actual measurement is that of the dry cell circuit. Hence this measurement is entirely independent of the resistance of the circuit, including the thermo-couple, lead wires and galvanometer.

The potentiometer can be used with any length of leads desired, and the indications are entirely independent of line-resistance or changes in resistance due to atmospheric changes in temperature along the leads. The potentiometer has a disadvantage as compared with the milli-voltmeter method of temperature measurement in that some outside source of current, a dry cell and standard cell, for example, are necessary as a source of current and the dry cell must be replaced from time to time. The standard cell likewise is liable to injury if subjected to temperatures below 40° or above 104° Fahr. and the standard cells must be checked occasionally.

The claim is made that the sticking of the movable element of the milli-voltmeter may cause erroneous readings and that the potentiometer eliminates this. This statement is a fallacy in that the potentiometer also incorporates a galvanometer, and provided the galvanometer sticks, an erroneous reading is secured.

I recently developed and have been granted two patents on a type of portable precision potentiometer in which we use a spiral resistance winding for our slide wire. The total length of this spiral resistance on a cylinder 4 in. in diameter and 6 in. long is 8 feet. On a corresponding cylinder in the instrument the scale is in spiral form 8 feet long, in which the temperature can be read.

The operating mechanism moves the spiral wound resistance equivalent to the motion of the temperature scale and an index is designed to travel across this temperature scale dependent on the spiral line on which the temperature is read. Naturally with the 8 foot scale, exceedingly fine temperature indications can be secured. Our standard instrument graduated to 2000° Fahr.. with base metal thermo-couple, is graduated to 2° Fahr. and can be easily read to a half in degrees Fahrenheit up to a total range of 2000° Fahr.

Potentiometer pyrometers are available in recording form, in which the mechanism automatically balances the voltage of the cell against that of the thermocouples, and in this instrument the records are automatic and no hand balancing is required.

In either the milli-voltmeter or in the potentiometer type, recording pyrometers are available to plot a continuous record of the temperatures on a chart daily, weekly or monthly, as desired. The recording pyrometers are supplied either to make a single record on a chart, or with two or more galvanometers side by side making individual records on one recording sheet. Multiple recording pyrometers are also available incorporating a switching mechanism, which alternately connects the various thermocouples to the galvanometer or milli-voltmeter in a recording instrument, and many records can be secured on one chart.

There are numerous methods of producing a record on the chart. The most common form is to use different colors for these individual multiple records, or by using for one record a single dot, for another two dots, the number of records can be multiplied. The records are made distinguishable also by dots, dashes and stars, corresponding to each record. In some instances the record is produced by jumping an electric spark through the record paper, and in others by a printing mechanism with numbers beside each individual record dot, corresponding to the particular thermo-couple recorded.

Where a recording instrument operates on the milli-voltmeter method the frictionless type of recorder is required and the pointer is depressed only momentarily at intervals on the recording chart. In the potentiometer type of recorder sufficient power is available from the motor operating the instrument to imprint a record directly on the chart.

Automatic signaling pyrometers have been used for some years in the larger heat-treating plants where it is desirable that the operator should not decide whether the temperature is correct or not, but should be signaled by lights, as to whether the temperature is within the correct limits. For some years it has been common practice to install a central indicating pyrometer with switchboard, and by means of three colored lights at each furnace, usually red, white and green, to signal from the central station whether the temperature is too low, correct, or too high. Usually 25° is considered a limit within which the temperature should be maintained.

The white light burns when the temperature is correct. If the temperature drops below, the green light glows, or if it rises above the desired temperature the red light burns. The operator of the furnace does not have to know how to read a temperature scale; all he need be instructed is to keep the white light burning and what he is to do when the red or green light burns.

Incorporated with this system is usually a signaling system to indicate when the steel is to be removed from the furnace, where a definite time interval for heat-treatment has been determined.

A step farther is the automatic signaling of the temperature by an automatic signaling pyrometer which can be incorporated in the standard form of milli-voltmeter pyrometer. Instead of the pointer being depressed on a record chart as in the recording instrument, it may be depressed on to contact plates representing the correct temperature, too high or too low. By incorporating with such an instrument a switching mechanism, a number of thermo-couples can be connected to a single indicating instrument and as many as twelve or more thermocouples can be connected to one signaling pyrometer, which will automatically operate the lights at the furnace, eliminating the operator who is now required to flash the lights from the central station.

Automatic Temperature Control Pyrometers

The day when the furnace temperatures will be accurately controlled automatically is coming very rapidly and notable progress has been made in this respect during the last few years.

The application of automatic control pyrometers to electric furnaces is a comparatively easy problem, as automatic switches can be easily operated by a solenoid which can in turn be operated by the same contact device in the pyrometer as used in the signaling instrument. We have applied automatic temperature control to electric furnaces most successfully, and some 100 electric furnaces to my knowledge are being controlled automatically at present.

This control may be secured by the opening and closing of the main circuit or line, or by cutting in and out a small portion of the available current, which is possible through cutting and out of rheostats. In this way the fluctuation in current is materially reduced as compared with opening and closing the main circuit.

Automatic control of gas-fired furnaces is a little more difficult, as a gas valve to be tight and not leak under continual operation must be well packed and considerable power is required to operate the valve. We have, however, by the use of powerful solenoids, or by motor-operated valves, been able to overcome this, and we have a number of gas-fired furnaces of large dimensions which are automatically controlled.

There is no question in my mind but

*Read before the American Steel Treaters' Society.

that within the next year or two the automatic control of furnace temperatures will be very generally adopted wherever a constant temperature is to be maintained and it is desirable to eliminate the human element and hand control.

I have developed a special type of automatic control pyrometer which can be connected to almost any number of furnaces. It was necessary to add the required switching mechanism to connect the various thermo-couples to the instrument and also connect simultaneously the various electrically-operated valves or switches.

Another step and we have already developed an instrument of this character, for which patents have been applied for, is an instrument in which the contact table carrying the high and low contacts is moved along the temperature scale by clock mechanism at any desired rate of speed so that where a furnace must heat up at any given rate, this can be accomplished automatically.

Assuming, for example, that a large annealing furnace should have to attain a temperature of 1600° Fahr. in twenty-four hours. The clock mechanism advances the contact table across the scale to 1600° Fahr. in the period of twenty-four hours, and when this temperature is attained the current can be automatically shut off if desired, opening the switches to an electric furnace or closing the valves if a gas furnace is used.

The problem which has offered a little difficulty, but which we seem to be rapidly solving, is the automatic control of oil-fired furnaces, as the oil burners usually operate under high pressure and the burner may become clogged. which will be noticed if an operator is available, but offers difficulty with automatic temperature control. I feel that we are rapidly reaching a point when this difficulty will be solved by securing an automatically-operated burner which is foolproof and will not clog.

Pyrometers in Steel Treatment

I think many are not aware of the part pyrometers play in steel treatment from the smelting of the iron until the finished product. Let us take a part made from high-grade alloy steel. First in the blast furnace where the iron is smelted; the hot blast temperatures and the temperature of the escaping gas from the furnace are accurately controlled by thermo-electric pyrometers.

Next, the open hearth furnace where the steel is refined. Temperatures are very largely controlled in these furnaces by installing a platinum thermo-couple in the slag pocket or the gases from the checker brick. A very satisfactory record can be secured on a recording pyrometer of the working of the open hearth furnaces in this indirect manner. Optical pyrometers are also used to focus on the molten steel in the furnace or on the steel in pouring.

The forging of steel carried on in forging furnaces at a temperature of around 2000° Fahr. is accurately controlled with the aid of thermo-electric pyrometers. using platinum thermo-couples with special Durax tubes.

The annealing, hardening, re-heating and the quenching temperatures are realized by everyone to be of the utmost importance and should be accurately controlled with pyrometers. Where oil or water is used for quenching, recording thermometers or resistance thermometers are applied to advantage.

This will give some idea of the part pyrometers play from iron in pig form to the finished steel part, the recent improvements in pyrometry, and the outlook for the next few years. I want to make one point clear, however, that while we are continually striving to improve the pyrometers which we manufacture and design these instruments to better meet each requirement, our efforts are a failure provided we cannot educate the users of pyrometers in how to use and care for them.

I have seen the best of pyrometer installations give unsatisfactory results simply because it was assumed that when pyrometers were installed that the steel in some miraculous manner would come out perfectly heat-treated without any attention whatsoever. The pyrometers were apparently supposed to be infallible, and that while a watch has to be wound and adjusted occasionally, the pyrometer should require no such attention. There are no pyrometers produced to-day which do not require some attention, and if you are told by any pyrometer salesman that his instrument will work year in and year out without the slightest attention, you can put it down that he has too vivid an imagination.

If you instal pyrometers, take the time to make a little study of how the instruments operate, how they can be best installed, and how they are to be cared for after they are in use in your plant. If you have quite a number of furnaces and a considerable pyrometer installation, place a man in charge of the instruments who has been first instructed in the information, anyone should have to handle such a job. Do not take an office boy to look after your pyrometer equipment as I have seen so often done. A first-class pyrometer equipment will pay for itself time after time during the year, and will be of infinite benefit to the user provided, first, it is properly designed to meet the conditions; second, it is properly installed: third, it is properly understood and cared for.

We are struggling every day to make pyrometers better. Can we not count on the users of pyrometers to endeavor every day to make the care of the pyrometers better? If this can be accomplished, then the troubles with pyrometers will very rapidly disappear.

PACKING BOXES WITHOUT NAILS

Arrangements are being made in Great Britain for increasing the output of a novel and ingenious form of packing crate or box. It requires no nails, no screws, no hinges, no wires; it is collapsible, and when put together, is capable of holding any kind of merchandise. Rigidity is obtained by a system of interlocking parts. A special method of sealing the cases has been adopted to render the work of the pilferer more difficult. With the ordinary nailed-up box it is any easy job for the railway thief to apply a jimmy or a nail lifter, and restore the original outward appearance of the package after he has extracted the contents. With this new crate, it is impossible to extract any goods without leaving obvious signs that the package has been tampered with. Another advantage in these days of congested transport is that "returned empties" take only one-fifth of the space occupied by the non-collapsible box.

Probably the slowest work in wood shipbuilding is that of planing the woodwork, quantities of which have had to be done by hand as the ship goes together. A skilled woodworker at St. Helens, Oregon, set about to invent a planer that would work by means of compressed air. He finally made one that worked fairly well, but was cumbersome, weighing about 150 pounds.

Then some one at Portland took up this problem. He could see no reason why, if a small machine could be made powerful enough to drive great rivets by air, an equally small machine could not be made for planing. The result of his labors is a power planer operated by compressed air through a pipe, just as the "guns," or pneumatic riveters, work, and this weighs only ten pounds, and is but sixteen inches over all. It can be used in almost any place on the ship. taken anywhere and after being tested for more than ten months. shows that it needs no changes or repairing other than the customary sharpening of the blades.

One of these planers will now do more work and better work than twenty men with hand planes can do in a day—a fine record for a simple device.

Canadian Machinery Drafting Course, Part 10

The Definition of a Surface, Straight Line Development, Curved Line Development and Other Details in the Art of Development of Surfaces Are Explained in This Section

By J. H. MOORE, Associate Editor Canadian Machinery

IN this last portion of our elementary study, before entering the strictly mechanical field, we will consider the subject of the development of surfaces. The subject is a very important one and the various explanatory sketches should be studied carefully before proceeding with the plate itself.

What is a Surface?

A surface may be described as follows:

A surface is that formed by the motion of a line. Any length of line moved sidewise in any direction will form a surface, of a width equal to the length of that line, and of a length equal to the distance over which it has been moved.

There are, roughly speaking, two different types of surfaces, namely, those formed by, first, a moving straight line, and secondly, those formed by a moving curved line.

In some classes of work, patterns of the complete or partial surface must be made, as in sheet metal work, stonecutting work, etc., etc. Where there is some irregular surface, there must be a pattern made, giving the shape of the developed surface, so that when a sheet is cut (in sheet metal work for example) it can be so formed that it will be of the same shape as the original.

It is this templet, or pattern making, namely, the laying out of the complete surface on one plane, that is termed developing the surface. Any surface which can be smoothly wrapped about by a sheet of paper can be developed. Figures made up of planes and single curved faces only, can be included in this section. Double curved surfaces and warped surfaces cannot be developed, and patterns of such surfaces, if desired, must be made by an approximate method which requires two or more pieces to complete the pattern.

By ascertaining the true size of all the faces of an object made up of planes and joining them in proper sequence at their common edges, the completed developed surface will be found. The best method of accomplishing this is to find the true length of the edges of the object.

Straight Line Development

At Fig. 1 we show an object of very plain nature in the shape of a rectangular block of steel, which has a similar shaped hole through it in central location. Now, the question is as follows:

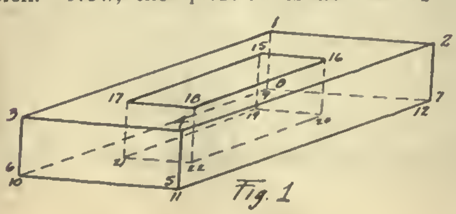


Fig. 1

How would this object look if developed on a single plane?

Referring to Fig. 2, first let us consider the mechanical drawing, showing how this piece would appear. You will notice that we have marked the various edges, Nos. 1, 2, 3, etc., etc.

Following closely these views, and looking on the developed figure at Fig. 3, the reader should have no trouble in grasping the idea.

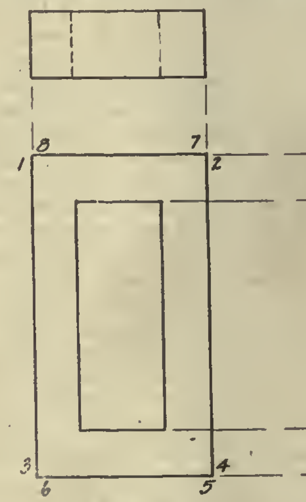


Fig 2

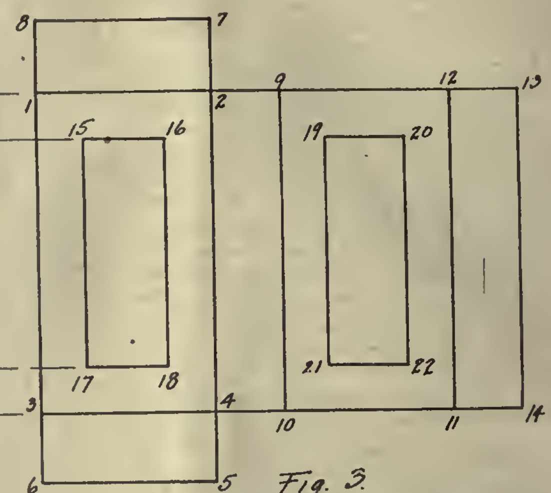


Fig. 3

Briefly the idea is to take the complete object and place it on one plane, in other words, all four faces of the object are placed on the same plane.

The developed rectangle, 1, 2, 3, 4, shows the top of the rectangle, 3, 4, 5, 6, illustrates one end 1, 2, 7, 8, the other end, while 2, 4, 9 and 10 illustrates one side. In like manner 9, 10, 11 and 12 shows the bottom, while last, but not least, 11, 12, 13 and 14, illustrates the other side.

This development is then the exact size and shape of a covering for the prism or original object. In other words, if the development as shown, was made in sheet metal and bent up to shape, the result would be a prism of correct shape. Of course, as readers can understand, such a prism made of sheet metal would be hollow, and not of solid material, as the object shows, otherwise the shape would be exactly the same.

The rectangular hole through the object is illustrated by the lines 15, 16, 17 and 18 in one view, and with lines 19, 20, 21 and 22 in the other.

As a summary, we might add these words: The development of a right prism consists of as many rectangles joined together as the prism or object has sides, those rectangles being the exact size of the faces of the prism, together with two polygons the exact size of the bases.

In every case it will be found a great help to number all corners on the object and projected views, as shown in our illustrative sketch.

The Curved Line Development

Let us now take a case of curved line development in this example, a cylinder as shown at Fig. 4. To develop this surface is a comparatively simple matter and for illustrative purposes we have considered an imaginary line, 1, 2, as a starting point, developing from there.

The result is shown at Fig. 5. In other words, the development is a resultant surface on a flat plane of a width equal to the length of the cylinder, and a length equal to the perimeter, or all around distance of the curved line of the cylinder. This problem is so self-apparent that we dwell no further upon it.

The Principle Applied to the Cone

We will now go a little deeper into the

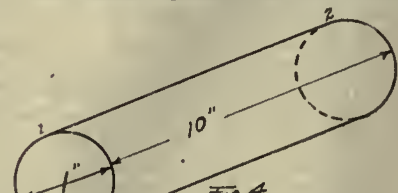


Fig. 4

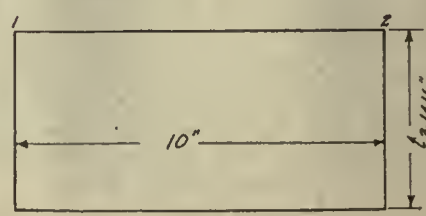


Fig. 5

problem of development, and consider the cone shown at Fig. 6.

Here we see a mechanical drawing of a cone cut by a plane parallel to the base, by the line A B, considering for illustrative purposes that the vertex C still exists.

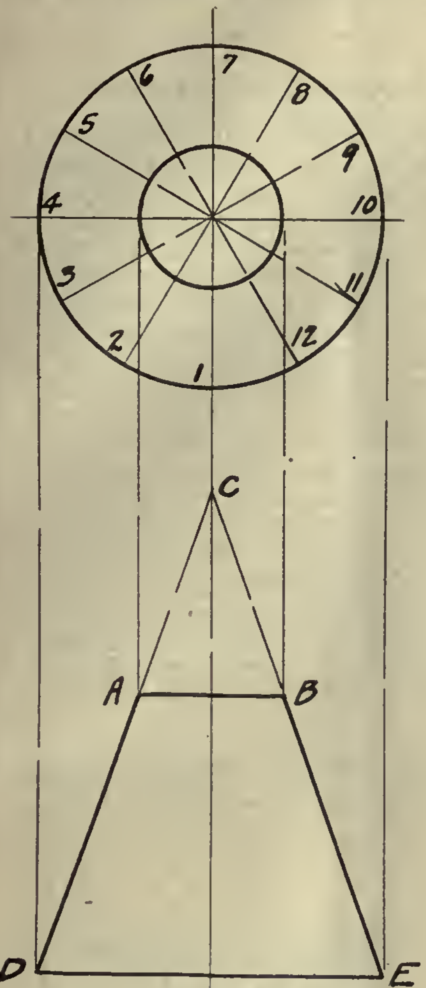


Fig 6.

To make a true development, proceed in the following manner:

We will now suppose we are about to roll the cone on a flat plane, the vertex remaining stationary until the same element is in contact again, the space rolled over representing the development of the convex surface of the cone. Now look at Fig. 7.

Let C, as before, represent the vertex. C F will, of course, be equal in length to either contour element of the cone. This distance is taken from the elevation view. For example, C E is equal in length to the radius C F. Next, work on the plan view at Fig. 6. Divide this circumference into some convenient number of equal parts, 12 for this case in point, and transfer these spaces to the radius formed on the partially developed view, namely, F 1, 2, 3, etc., up to point 12. This point is the end of the arc, or developed surface. From here draw a line to the vertex, as shown.

Next, space your compass to the distance C A or C B on elevation view, Fig. 6, and draw an arc of this radius on the developed view, Fig. 7. The result is, the developed surface of the cone shown at Fig. 6.

A Final Example

As a last example we will consider a cylinder of the shape shown at Fig. 8.

This object if developed (or rolled, if you prefer), upon a plane, the various elements being parallel, will appear as parallel lines, and the base line being perpendicular to the elements will appear as a straight line of length equal to the circumference of the base. The base of the cylinder shown will be for illustrative purposes divided into 12 equal parts.

Let us first follow the procedure on Fig. 8. Divide the plan view into 12 parts, then project down in the matter illustrated to the elevation.

As a next step, let us look over the developed view, Fig. 9. On the base line of the view, step off the distances as marked on the plan view, 1, 12, 11, 10, 9, and so on the result being the completed base line 1 to 1, which is equal to the distance around the circumference of plan view. This gives the total width of developed view.

Project lines up from these points as shown, and lines across from elevation view. Where these points intersect are the development points. It will be seen that the curve formed is symmetrical, the half on the left of point 7 being the same as that to the right. The development of any similar surface may be found in the same manner.

While we have not attempted to go into this subject of development very deeply, we have at least skimmed the surface and given readers sufficient information regarding the principles involved. As we have already stated in other portions of our course, this is not supposed to be a detailed course in the art of mechanical drawing, but rather a general talk on the subject to familiarize the average reader with the underlying fundamental principles.

To give, in this form, a detailed course would take years, but by touching to some extent on each subject the reader at least gets some value out of it, which enables him to follow up the later plates, which will deal purely and simply with the subject of mechanical drawing. For this reason out studies are of equal value to the man on the bench and the man in the drafting office, for we aim to appeal to apprentices, machinists and apprentice draftsmen alike.

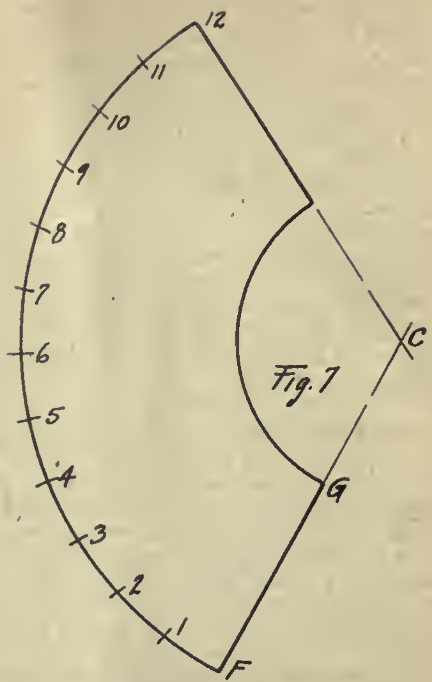


Fig. 7

Upon the completion of our studies we will, more than likely, appeal still more to the man in the machine shop, for he will see objects which he will be more familiar with, and the drawings will be more practical than theoretical as at present. We would therefore suggest that those readers, machinists or otherwise, who so far have said, "This course is not for me," look out for the next issue, and follow it up from the start of the subject of mechanical drawing proper.

In conclusion to this portion, let us consider plate No. 10.

As before, make your plate 9 x 13 to border lines, and divide up as directed. Purposely, we have shown only mechanical views of the various objects and ask readers to supply the developed views. The result will prove whether they have followed out the basic idea and principle involved.

We have illustrated no harder prob-

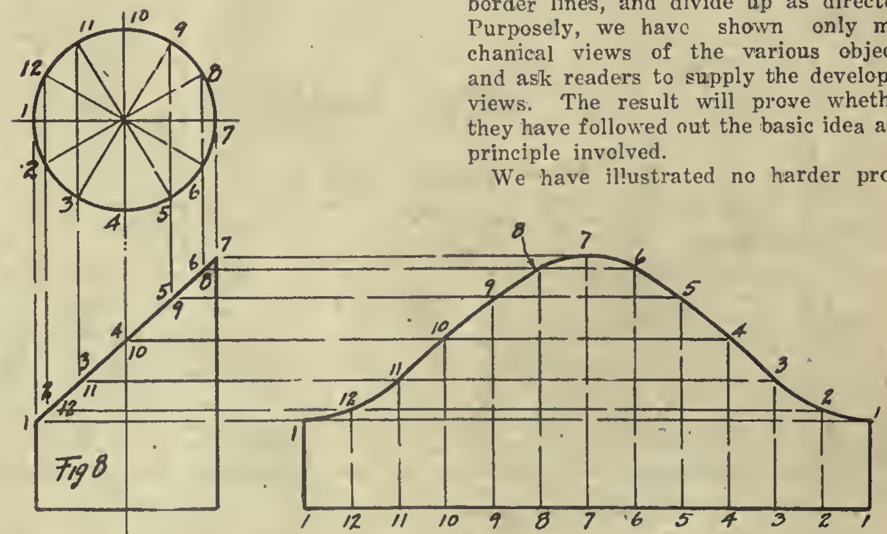


Fig. 9.

lems than we described, and have marked all necessary dimensions on the plate. Do not be discouraged if this subject proves a little difficult to start with, but plug along and work out these four problems. Above all, be neat in your work, space off your distances accurately, and take pains with your inking in.

As heretofore, we offer three prizes for the best three results sent in, so let us see your work as soon as possible.

To readers in general we can only once more add, Watch for Part II on this course, which should prove of special interest to all.

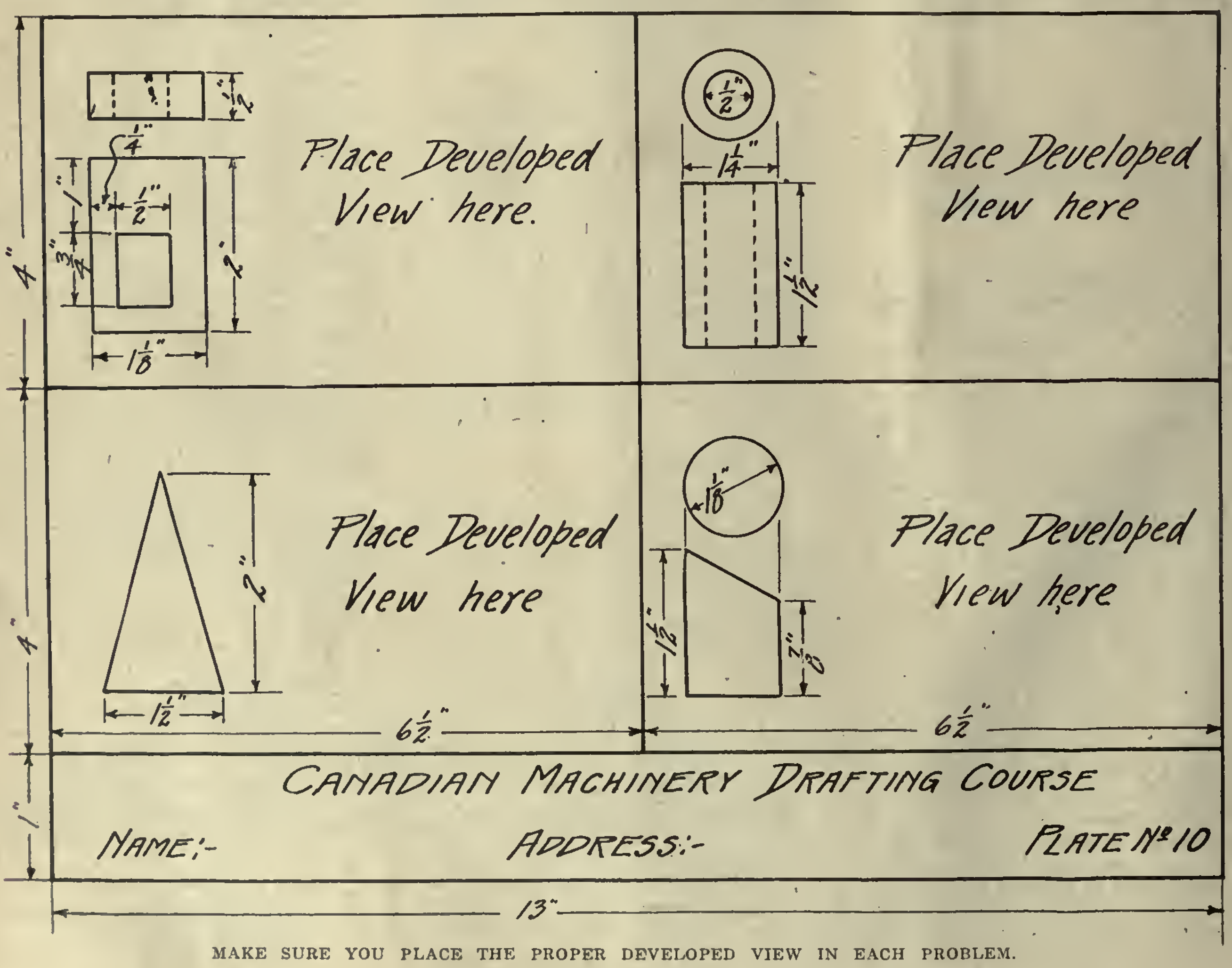
Excavation work in the north tube of the 14th St. rapid-transit tunnel under the East River, New York City, was completed Aug. 7, when the last piece of rock between the tunnel headings between Brooklyn and Manhattan was shot away. The river section of the tunnel is 3,437 ft. between shafts. The top of the tunnel is 97 ft. below mean high water at the lowest point, while the bottom is 115 ft. The maximum pressure used in driving the tunnel was 39 lb.

The head of the firm, when walking round the works, spies a young apprentice holding his hammer close up to the head. "Look here, my boy, that is not the way to hold a hammer. When I see a man holding a hammer properly by the end of the shaft I pay him $15 a week; when he holds it half-way along I pay him $10 a week, and when he holds it higher up still I only pay him $5 a week; do you understand?" "Yes, sir," says the boy, "will you please say where I am to hold it? I get $1.25 a week."

HERE IS GOOD NEWS FOR OUR READERS

CANADIAN MACHINERY is pleased to make the following announcement relative to their drawing course: Owing to the great interest taken in the course by our readers, we felt that some special effort on our part should be made to secure plates for our course, some practical and proven parts of a machine tool. This has been accomplished, and, starting with Part II, which enters into mechanical drawing proper, we will go through the following subjects: Milling machine, vise, important parts to a well-known miller, also various details on an up-to-date disc grinder. These subjects will be gone into in detail, gear problems, etc., discussed and figured out. We will take the student carefully and by easy stages from one detail to another, not by quick jumps which would only tend to confuse. All dimensions will be given and, as stated before, these are actual parts now in operation.

The value of this announcement is easily realized, so our only comment is as follows: Your opportunity to dig in and obtain results is here. The winter months are upon us, therefore it is easier to stay in and study. Send your plates promptly. In our January 15th issue we intend publishing a list of prize winners on the various plates. Watch for your name.



MAKE SURE YOU PLACE THE PROPER DEVELOPED VIEW IN EACH PROBLEM.

Tools and Plant from the User's Point of View

By "UBIQUITOUS"*

I have been asked whether in view of a possible permanent reduction in the calorific value of coal gas it will have a deteriorating effect upon the power development of gas engines, and whether if gas is supplied less rich in heating value it can be converted into power without an equivalent loss in efficiency and economy. I am not sure that I can explain this matter within so restricted a scope as this, but at any rate I will try. Let me then first of all say that I don't think it will, and then I will tell you why I think so. To obtain the best results within the cylinder of a gas engine richness of gas is of less importance than mixture, the correct proportion of air to gas being the all-determining factor. In other words, the relative calorific value of a gas is subsidiary to its chemical composition. Two examples prove the truth of this. Town's gas of a quality of 600 B.Thu.U. per cubic foot might be used as against producer gas of from 110 to 130 B.Th.U. per cubic foot, and yet the ultimate difference in the matter of efficiency would not, relatively, be anything approaching the difference in heating value per cubic foot. Then, again, many gas engines are working very efficiently and economically on blast-furnace gas having a heat value as low as from 80 to 90 B.Th.U. per cubic foot—which goes to suggest that it is much more a question of air dilution than quality of gas.

The Importance of Chemical Composition

It has been said that the chemical composition of a gas is all-important. I will show you why this is so. Take, for example, coal gas of, say, a standard value of 500 B.Th.U. per cubic foot. This would be composed of hydrogen, marsh gas, ethylene, and carbon monoxide as the principal combustible constituents. Now each of these elements possesses a different and definite calorific value, yet while these four ingredients may be of any relation or proportion to the others, their combined heat value would still remain 500 B.Th.U. per cubic foot of composite gasses. But as each separate element will require more or less air to furnish necessary oxygen to support combustion, it must follow that according to their relative proportions so the amount of air required will be greater or less. This again suggests that air dilution is important. Take a gas engine using coal gas of a value of 500 B.Th.U. We knew that this must be diluted with air to the extent of about 90 per cent. in order to obtain the best effects from combustion within the cylinder; consequently the mean calorific value of such a mixture would be, say, 500 ÷ 10 = 50 B.Th.U. per cubic foot. We should get practically the same effect in an engine using producer gas having a ter amlvlaue of say, 110-120 B.Th.U. per cubic foot, the difference being made up in the reduced quantity of air required. Thus assuming this value for the gas, and about equal quantities of gas and air to form the explosive mixture, its mean value would be therefore roughly equivalent to that of the previous example. In other words, more gas but of a lower heating value must be admitted to the cylinder in order to make up in quantity what it lacks in quality. And the extra consumption involved will not so much matter if, as it is suggested, we pay for calorific value in B.hH.U. and not in cubic feet passing the meter.

A Belt Calculation for Electrical Machinery

Just recently I came acros an extremely simple and reliable rule for calculating the width of belting required to drive electrical machinery when the output in watts of such machinery is known. It is as follows:—One foot per minute of belt speed per inch of width will transmit one watt of electrical energy. Therefore if the belt speed in feet per minute is mutiplied by belt width in inches the result will be total energy delivered in watts. If divided by 1,000 the result will be kilo-watts. This rule holds good for single belting; if light double belting, then from 30 to 35 per cent. additional energy may be expected. So that from this rule we can obtain the width of belt required as follows:

$$\frac{\text{Amps} \times \text{Valts}}{\text{Velocity}} = \frac{\text{Watts}}{\text{V}} = \text{width of belt in inches.}$$

The Value of a Gas Blow-pipe to the Ironmonger

One of the most useful as well as profitable items in the equipment of an ironmonger's workshop is undoubtedly a gas blow-pipe. Its uses are really too numerous and comprehensive to fully enumerate. It can be employed with equal success in the soldering, brazing and annealing of small articles, hardening and tempering drills, taps, dies, reamers, cuters, lathe and shaper tools, for burning old paint off machinery, for melting lead and tin, besides a whole host of minor unremembered operations. In conjunctions with a blow-pipe a double-action foot bellows, operated by the foot is a necessity. The blow-pipe should be so constructed that the air passes through the middle of the flame, not around it. Equalising and adjusting taps should be provided both for the gas and the air. If the proportion of air to gas is correctly adjusted the greatest economy is effected, and all the gas will be properly consumed; but if too much air is used the flames loses its heat. Most workers in a desire for economy use too much air. The quantity delivered by an aperture, say, 3-16 in. diameter will required practically all the gas supplied by a ½ in. pipe. Indications of smoke or soot on the work denotes an insufficiency of air. Always use flexible metallic tubing in preference to rubber, as the latter possesses a provoking habit of kinking and stopping supplies.

Haw to Use a Hack Saw

A deal of skill is erquired in the use of a hack saw, that is if saw breakage is to be avoided. In the first place the saw requires to be set quite firmly in its frame, given a fair amount of tension, and so held that twisting is prevented. In its use it must be remembered that the teeth are given a certain amount of rake or inclination in order to cut one way only, that is in a forward direction. Therefore, cutting pressure should be applied only on the forward stroke, the saw being eased slightly out of the cut on each return stroke. As a rule, a hack saw frame is so arranged that the saw can be fixed in four positions, this being often a great convenience. Always use the full length of the blade if it is at all possible, the general inclination among workers being to devote all their energies to the middle thre or four inches, hence a saw is often scrapped as worn out when only about half its length is unfit for further service, the other half been practically as god as ever. When putting a new saw to work on hard metal, tool steel, or the like, use very litle downward pressure, otherwise the danger of ripping off three or four consecutive teeth, and so uttterly spoiling the saw, is always present. Use a dry saw for cast iron, bras or gunmetal, but slightly grease it when sawing mild or teel steel. When a saw chokes withdraw it from the cut and rub it downwards with the finger and thumb pressed tightly against the teth. Present-day hack saws are invariably too hard to be re-sharpened when becoming dull; and it is questionable if it would be a paying policy to do so, wer it possible.

Coiling a Band Saw

Mention of saws reminds me of a little knack of coiling a band saw when I saw done the other day. This is termed the "three-fold coil," and, I was assured, is the only safe way of coiling a band saw without risk of distorting it. Place the saw in a single loop as it goes on the machine, standing on the floor with the foot holding down the lower part of it. Now grasp the upper part with the two hands about 2 ft. apart, and level with the face. Give the saw three distinct twists and the nstoop lowering the saw to the floor, when it will fall naturally into the three-coil fold.

Revivifying "Perished" Brass

It may not be generally known that

*From "Hardware Trade Journal."

brass wire, brass strip, or brass stamped articles that have been stored for any length of time, and subjected to varying atmospheric influences, loses its strength and ductility, and shows signs of "perishing." Such injurious effects may almost entirely be eliminated by heating the metal for a few minutes to a temperature of between 500° and 600° C., then cooling the metal either slowly or quickly. A useful hint to those of my readers who have to store such lines for any length of time is to keep all brass goods tightly and securely wrapped up in plenty of clean dry paper, and well tied to exclude the outside air.

Color of Oil Engine Exhaust

I learnt a wrinkle the other day that is worth knowing. An expert was overhauling an oil engine, and he had got it running for the first time. After making the usual examinations as to smooth and quiet running, the condition of the bearings, and so on, he went outside the engine house and critically watched the exhaust gases leaving the exhaust pipe. Being abnormally curious, I questioned him as to the reason for such a procedure. Said he: "The color of the exhaust from an oil engine is always a sure indication as to the manner in which it is working. Under medium or full-rated loads this should be almost invisible, which goes to show perfect vaporisation and combustion; under light loads the exhaust should be just perceptible as a white or whitish-blue vapor. Corrections, if these conditions are not being fulfilled, would be the adjustment of the oil fuel, air supply, and water injection." . . . Something more learnt.

Two Styles of Handy Trays for Finished Parts

By ROBERT MAWSON

TWO styles of holding and carrying trays for finished parts of a cylindrical shape are shown in accompanying illustration.

The one designated Style A was made to hold elements such as gears and pulleys, in which a hole had been bored in a previous operation.

The last operation on these gears was cutting the teeth, the pieces being just turned, faced and bored. The blanks were then taken to the gear cutting department, but it was often found that some of the parts were damaged after the teeth had been cut, by the operator allowing them to drop against other gears.

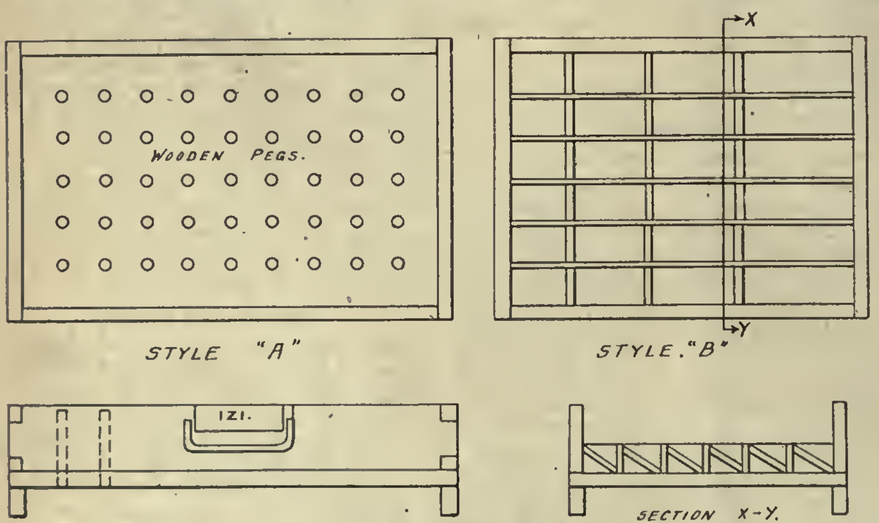
In some cases the teeth were broken away, which meant that these gears were only good for scrap. To overcome such trouble, the trays as illustrated was made.

A wooden frame provided with legs of sufficient height was made so that a light truck could be used to transfer the loaded tray from one department to another. Wooden pegs were driven into the tray at sufficient distance apart so that the gears would not touch each other on their periphery.

In front of the tray was fastened a metal part-card holder, so that the whereabouts of any certain part could be readily ascertained by the routing department. The second type marked B was made to hold circular discs, in which no holes were machined.

In this case the pieces were turned and faced all over by being held in a universal chuck. The last operation was grinding the faces and bevelling one edge almost to a sharp corner. It is easy to imagine how these elements could be injured even by the best of care if the sharp corner came in contact with another disc.

To avoid this the tray illustrated was designed. This tray is also made of wood with legs for the purpose previously noted. Slanting partitions were fastened inside the framework with cross divisions or partitions at right angles. The finest ground discs were then slid into the spaces. Their inclined positions made them easy to remove when desired. The cross partitions prevented any two discs coming in contact with each other and thus avoided injury.



VIEW SHOWING THE TWO STYLES OF TRAYS.

It might be added that these trays are not only cheap to make, but that they also tend to keep the machining departments much neater in appearance. Production is also likely to increase as the operator, foreman or scheduling department can tell at all times the condition or progress of the various elements through the shop.

A PRACTICAL BLUE-PRINT PROTECTOR

Blue-prints are always getting dirty, wet, greasy or torn while being handled by workmen using them.

An inventive genius has designed a very practical blue-print protector of simple construction and low cost.

A sheet of transparent sheeting—the same material used for lights in auto curtains—is cut to desired size. A piece of lightweight leather substitute is then cut about a half inch larger all around than the piece of sheating. This extra half inch allows for a lap-over on all but the top side of the protector. A sewing machine stitches the lap down to the sheeting forming a large flat pocket, open at the top for the insertion of the blue prints.

Both the transparent front and the coated fabric back are waterproof and grease-proof. Dirt or grease may easily be wiped or washed off either without injury to the material. Both materials are flexible and the holder may be rolled up if desired in the same way an unprotected blue print is usually handled by a workman.

A further development of welding in American shipyards is anticipated from the recent approval by the American bureau of shipping of the thermit process for welding stern frames, rudder frames, and other heavy sections on ships registered under its classification. The only qualification is that this bureau be notified sufficiently in advance to have a surveyor in attendance during the welding operation as well as to inspect and test the weld when completed.

The man who adapts familiar equipment to new and useful ends is many times more valuable to his employer than the one who calls for a special machine for each new job that develops. Compressed air is a valuable and easily adaptable power around a plant.

WELDING AND CUTTING

Electric Arc Welding

By F. A. ANDERSON,* San Francisco, Cal.

IT IS only a few years ago that the subject of electric arc welding would have aroused but little interest, and yet to-day the art is engaging the attention of many men standing high in the engineering profession.

At the present time electric welding may be divided into two general classes, resistance welding and arc welding. The former had its inception some thirty years ago, and has been practised more or less continuously ever since, gaining in popularity as its many applications have proved themselves valuable.

In this process the necessary heat is produced by current flow through the high resistance of metals in contact, and when the proper heat is obtained the completion of the weld is accomplished by the application of pressure sufficient to unite the molten masses into one. This is the fundamental principle of the many spot and butt welding processes in use to-day.

Arc welding is about twenty years old, and was probably first introduced by Zerener, who devised the means of holding two carbons of opposite polarity in a V form and employing an electric magnet for forcing the arc toward the work. The desired heat was thus obtained directly on the metal to be welded, and welding wire was fed into the arc, filling the void and completing the work. This early process resembled that of the acetylene torch and is rarely used to-day.

The next improvement in the art was due to Bernardos, who dispensed with the electromagnet and one carbon, using instead the work as one side of the circuit and a carbon as the other. The arc was struck directly on the work, immediately producing the desired heat, and at the same time the welding wire was fed into the work, This process is still extensively used and lends itself most advantageously to many phases of modern practice. It is generally referred to as carbon welding.

A further development was made by Slavianoff who introduced the method of using the welding wire for both striking the arc and feeding it into the work. As a result the welding wire became known as the electrode, and the process as metal-electrode welding. It is one of the most generally used to-day, and whenever discussing it the term "electrode" refers to the metal added in the operation and the term "parent metal" to the metal to be welded. In recent years the term "arc welding" has been understood to mean metal-electrode welding, and it is generally customary to qualify the phrase when referring to carbon welding.

In the past a great many failures of welds have been largely due to the operator, who did not manipulate the electrode so as to bring the parent metal to a molten state. This resulted in the electrode being deposited on but not uniting with the parent metal, since no pressure is added to complete the union.

As an example of one such failure, the following may be of interest. A short time ago the writer was connected with an enterprise where difficulty had been experienced in successfully expanding 6 in. extra heavy pipe into steel flanges. This method, however, proved unsatisfactory. Both the screwed flange and the Van Stone or flanged joint had also been disapproved, and when arc welding was suggested the writer was asked to make a sample for test.

It is still generally believed that the metal, in passing through the arc loses all its ductility and elasticity and assumes characteristics wholly those of cast iron or steel. The turnings of this weld, however, presented an appearance similar to good machine steel, and when analyzed showed the following: Silicon, a trace; sulphur, 0.075; manganese, 0.23; phosphorus, 0.0018; carbon, 0.25.

While it was essential that this weld be able to stand a steam pressure of 200 lbs., the sample was tested first at 500 lb., then at 800 lb., next at 1,000 lb., and finally the pressure allowed to go the available limit of 1,400 lb.

This test was witnessed by a number of interested parties, but one skeptical member asked that the specimen be given a hammer blow with the full pressure on. This was readily agreed to, and, since the workmen refused to strike the blow, the writer secured a 14 lb. hammer and struck twelve blows on the face of the flange, after which examination was made and no damage whatsoever was apparent. Six blows in the reverse direction were also given without producing any failure of the weld.

The weld was then tested. It was believed the weld was not more than 25 per cent. efficient, for the operator had not given his best efforts to the work, and as the welding material was only of about 50,000 lb. tensile strength, the effective area of welded material would probably show about 250,000 lb. This, however, was greater than the strength of the twelve ¾-inch flange bolts, which was perhaps 150,000 lb. The weld was then pulled in an ordinary testing machine at 119,000 lb.

Although the test had proved the weld capable of sustaining a strain greater than ever likely to be met in service, it was completed by breaking the weld. To do this the flanges were enlarged, and when the piece was again pulled the weld gave way at 208,000 lb., but before this the flange on each end had dished about ½ in.

The results of these tests, while showing that such a weld might be serviceable, nevertheless justify the statement that the weld was a failure, for the broken specimen showed that only about one-fifth of the welded material united with the pipe and flange. This was the most apparent from the specimen itself, which thus justified the previous estimate, since 208,000 lb. is practically 20 per cent. of the amount which it was assumed the weld would hold when figuring the 25 per cent. weld at 250,000 lb.

In passing, it is of interest to note that in one of the large manufacturing plants near Philadelphia, Pa., there is a 2,000 lb. hydraulic pipe system installed, every joint of which is arc-welded, and although it has been in service a year and a half, no joint has developed a leak or given any trouble. There are a number of firms to-day who are using electric arc welding for securing flanges to pipes and making T and other connections on steam lines, and their excellent records testify to the ability of arc welding to withstand the many strains of time and service.

Many other examples could be presented. The following is one of particular interest as it shows the service to be expected under severe conditions.

On the large 16-wheel articulated locomotive it is necessary to have a ball joint in the steam pipe between the two trucks, and one manufacturer has, for about six years, used the arc welding

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Abstract of a paper presented at a meeting of the San Francisco Section of the American Society of Mechanical Engineers.

*Electric Inspector, U.S. Shipping Board.

process to fasten in place the ball of this joint. This weld must stand vibration from the jar of the locomotive over track and joints, tension and compression from the forward and backward movement of the train, reverse strain as the curves from right to left are made, and an internal steam pressure of about 100 lb. Six years' service has brought no reports of failure.

As an illustration of the saving in time and money often resulting from arc welding, the following incidents are typical: The Italian ship "Titania" had a badly damaged rudder, but it was successfully repaired by arc welding at a saving of $10,000 and 4 months and 2 weeks of time. One part of the weld was completely through the 6 in. by 9 in. rudder post. This vessel was repaired in August, 1916, and has since seen constant service.

A report of the electrical engineer of one of the great middle-western railroad systems accredits to arc welding a saving of about $200,000 in one year. This saving was computed from economy in this method over others previously used on the same class of work, and also from the saving effected by the restoration to service of otherwise useless apparatus. Since that report this road has increased its number of welding unit about 300 per cent.

Among the great lessons which the recent war has taught us are economy and the conservation of our time, energy and raw material, and arc welding presents a veritable storehouse of opportunities ready for the engineer who will adapt them to his own requirements.

In the course of the discussion which followed Mr. Anderson's paper the following interesting facts were brought out. Since 1906, the Pelton Water Wheel Co. has used arc welding for very heavy work in building up large steel castings. In making these castings the shrinkage stresses are so severe that the reinforcing ribs are often pulled apart and ruined. The reinforcing ribs are therefore cut to allow for this shrinkage and then welded.

In discussing the relative merits of alternating and direct current, the consensus of opinion seemed to be that direct current is the more suitable for arc welding. Alternating current can of course be used, but it takes a more experienced man to maintain the arc, and in practice there are very few that are able to weld with any degree of satisfaction.

In discussing the question, What, in general, is the effect of the weld on the character of the metal? it was brought out that metallurgists and chemists are trying to arrive at some standard for electrodes. It must be remembered, however, that the parent metal has certain constituents that become molten. The electrode also becomes molten and it has certain constituents. These two commingle and form other elements which disappear in the heat of the arc, are carried off in the oxide, and sometimes, strange to say, form a new composition. The advocates of the covered electrodes claim one thing, others use fluxes, and still others metals in various proportions, and every one is claiming certain results for the particular method he uses.

MULES IN A CHINA SHOP

The old saying in regard to the consternation brought along by a "Bull in a China Shop," has probably been easily paralleled by the recent shipment to Indo-China of 30 Bates "Steel Mule" Crawling-Grip Tractors, by the Automotive Products Corporation of New York.

This shipment is interesting to the American manufacturer and exporter from more than one point of view. In the first place selection was made after careful investigation by representatives of the buyers in this country. The tractors also had to be specially prepared for shipment so that they could upon their arrival, without any unnecessary delay, be put into running condition as they were to be driven under their own power a long distance into the interior.

Saigon, the shipping point, is the capital of the province of Cochin China, one of the sections of that great far Eastern territory controlled by France and comprising Indo-China. This area includes the great tracts of Annam, Cochin China, Tonkin and Cambodia, covering some 250,000 square miles and having a population of 20,000,000. Saigon itself, a city of some 50,000 population and about 30 miles from the sea, is one of the finest modern cities of the Far East and possesses many of the features that might be considered lacking in an area that for hundreds of years was controlled by the great but nomadic and warlike race of Mongols.

The tractors were packed and equipped not only for their journey half-way across the American continent and then across the Pacific and China Seas to Saigon, but also for their long inland journey. They will burn kerosene as fuel, on account of the high price and difficulty in securing gasoline. While the coasts of Indo-China are swampy, marshy and low-lying, the interior is rough and mountainous and, unlike vast areas of China, is heavily clad with forests. Many sections of the country are extremely fertile and grow crops of sugarcane, rice, cotton and even tobacco. The tractors are to be used in opening up new areas to intensive cultivation and some day we may be sweetening our coffee with sugar, eating the rice and wearing the cotton clothing that has been cultivated by these tractors sent from our own country.

PEAT, ITS EMPLOYMENT DURING THE WAR, AND ITS FUTURE

Mr. P. Willems, after giving a short history of the peat industry, remarks that the composition of peat varies greatly even in the same bog. He points out that in such countries as Norway, Sweden, and Denmark, where there is little or no coal, the peat industry is assisted by a Government subvention and by expert advice. In France, 70 years ago, about 500,000 tons of peat were raised annually; but this gradually decreased, until in 1913 it was only about 60,000 tons, and the industry received no aid from the Government.

When, during the war, the scarcity of coal became pronounced, the French Government decided to encourage peat-digging, but only small hand tools were generally available. The old mechanical diggers worked by hand power through gearing were able to raise a block of peat 0.30 m. x 0.30 m. x 6 m. deep (say 12 in. x 12 in. x 19 ft. 8 in. deep). Some of these were found and repaired, and it is hoped to obtain very soon, simple machines driven by a motor of 4 or 5 h.p. which will be able to raise 100 cubic metres of peat per day of 8 hours. Peat-mixing machines are now made which will treat 8 to 10 cubic metres per hour, and make it into cylinders pierced with holes; these, after drying, are ready for use.

In 1918, about 500,000 tons of wet peat were extracted, producing 100,000 tons dried, so as to contain 35 per cent. of water. It has been proved that steam boilers can be worked satisfactorily with a mixture by weight of one of coal to three of peat; 1½ tons of peat are equal to 1 ton of coal. Domestic closed stoves can be fed with anthracite (or coke) and peat in equal parts. When coal falls to the normal price the use of peat as fuel will no doubt decrease, but then will be the time to distil the peat and obtain combustible gas and by-products.

The author describes some of the minor uses of peat, such as that of bedding for animals, paper and textile making, but these would scarcely find a use except during such circumstances as were produced by the war.—Proces-verbal de la Societe des Ingenieurs Civils de France.

A company at Elizabeth, N. J., is plating iron sheets with copper by a new process. The plating metal is applied to the sheet in the form of a soft mixture by means of rolls, such as inking rolls. The sheet, after being coated with this mixture, is automatically carried forward and deposited on a link-belt conveyor, which carries it through a furnace maintained at a temperature well above that of molten copper. The basic principle involved in this method lies in the application of the plating metal to the sheet while the sheet is cold and then melting the metal in place on the sheet under conditions which are favorable to the formation of the plating.

Because of the law prohibiting the employment of boys in the anthracite mines of Pennsylvania, the operating companies are employing old men in their places, as slate pickers, jig operators, chute tenders and oilers in the breakers.

The potential output of petroleum from the wells of Mexico is, according to information furnished by the Secretary of Indutsry and Commerce, equivalent to over 250,000 cubic metres daily but the actual output is only about one-tenth of this amount.

DEVELOPMENTS IN SHOP EQUIPMENT

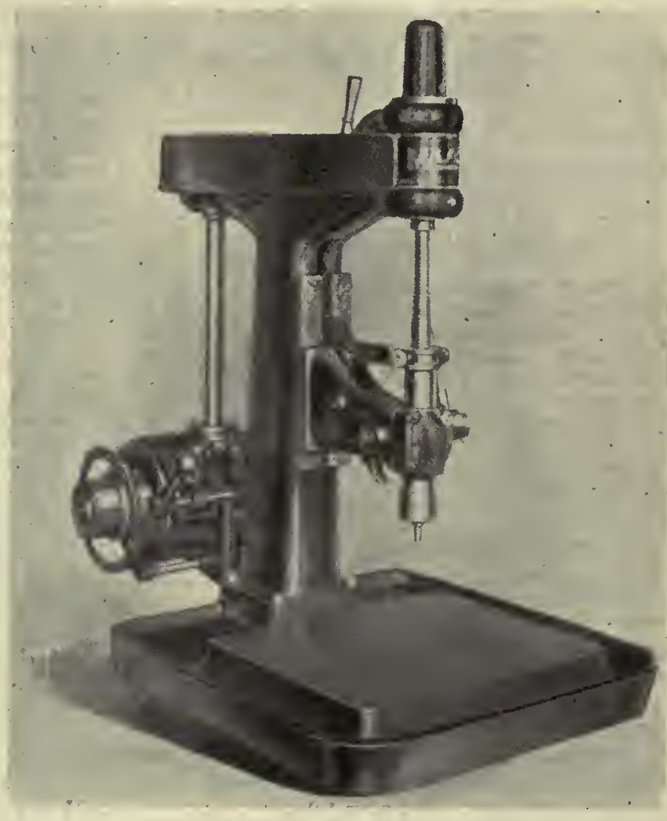
MASON DRILLING MACHINE

The Arthur C. Mason Inc., of Hawthorne, N.J., have recently placed on the market a high-speed, sensitive, ball-bearing, drilling machine.

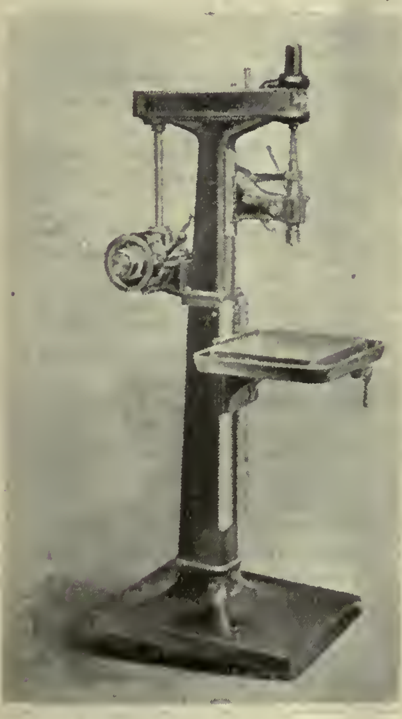
Three prime factors have been incorporated in this quick change machine, namely:

Efficiency, lasting accuracy, and ease of operation. Further improvements have been made to bring out a machine of unit construction which permits ease of adjustment for wear and replacements. The total elimination of frictional bearings, the entire absence of belt trouble and the directness of drive, induced positive and instant speed changes with ball-bearings throughout. All danger from exposed moving parts is entirely eliminated.

The design is somewhat heavier than usual, which makes for greater rigidity under highest speeds. All moving parts have been covered, with the idea of "safety-first" in view. The nose of the chuck is the only visible moving part on the whole machine. Operating levers have been placed within easy reach, and all speed changes can be made instantly without stopping the machine. There are no belt idler adjustments to be made whatever. Four spindle speeds from 3,000 to 10,000 are arranged for, and lower speeds in proportion. The machine is lubricated for six months from the date of installation, with the single exception of the spindle. An endless belt and a suitable chuck are furnished with the machine.



MASON DRILL BENCH TYPE.



MASON SENSITIVE DRILL.

The Drive

Power is applied through a pair of tight and loose pulleys, to a specially designed silent gear driving a vertical back shaft in connection with a straight horizontal endless belt, to the spindle.

A woven belt is furnished with the machine; all stretch is automatically taken up by an idler under-spring tension. The belt requires no attention for a period of from six months to one year. Belt slippage and wear is reduced to a minimum by the use of a special fabric composition spindle pulley.

The spindle is made of high-grade spindle steel, accurately ground, and is arranged with a double ball-bearing so that the thrust can be taken up in both directions; by this method all end play can be eliminated. Provision has been made for retaining a supply of oil to continuously lubricate spindle bearing, preventing its rapid wear at high speeds. The spindle balance has been arranged so as not to lessen the extreme sensitiveness.

The spindle sleeve is made of steel accurately ground, and requires no oiling. A convenient adjustment has been developed for quickly taking up the lost motion between the teeth of the sleeve and the pinion. A positive non-slipping depth gauge has been provided.

The spindle sleeve bracket is well proportioned and rigid; the spindle sleeve is guided by a feather; the clamping device is new and effective and quickly operated.

The table is heavy and of larger capacity than usual, and has a generous channel for catching oil or chips. In the column type the table is counterbalanced and is quickly adjustable to any position. The binder handle is always in the correct position.

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PRINCIPAL CONTENTS

Killing Patronage Again

THE Farmers' party in Ontario is reported as having a bit of a flare-up over a $3,500 per annum job in London.

The patronage system, of course, has been killed. It's been killed before, but generally keeps in pretty fair shape in spite of all the assassinations.

Will the politicians from lot 10, concession four, be any less keen to run in and take the Government jobs than the city and town type? We shall see.

Of course we are all ready to hoot and shout at the funeral of friend Patronage. We will walk through the moral cemetery and smile approval at the slabs they may weave to decorate his resting place.

And after all this has been accomplished, we turn home only to find old man Patronage standing on the main corner of the town, right across from the post office.

It has yet to be demonstrated that any political party can survive without the patronage system being on hand to haul grist to the mill.

Why Not Settle the Strike?

FOR months past a strike of moulders in this district has dragged along. Some shops have signed up, but many of the larger ones have not. As far as we can learn the chief trouble is with the 44-hour week, the foundrymen holding that they cannot grant this, as they are in competition with 48-hour shops all over.

Many good moulders have left this city and district. Some of them are working in places where the hours are longer than those they were working here before the strike.

There is a disposition on both sides, as far as CANADIAN MACHINERY can learn, to have this strike settled.

Why not make the effort? Is there a better way to start the New Year than by wiping out the scores that have made 1919 an industrial nightmare in many spots? It is time that reasonable and sensible men realized that limiting production and talking about lower living costs are not reconcilable.

The less we produce, the less we have to sell. The less we sell the less money in circulation, and the less able we are to batter down the smothering exchange rate against us in United States markets.

The fag ends of 1919 strikes should be wiped out. Get together on this proposition on a reasonable and sane basis. There are no insurmountable objects in the way. A little common sense, moderation and sincerity on both sides would start 1920 off on a good industrial basis in the Toronto district.

An Undesirable Condition

WRITING in the Toronto *Globe* of recent date in regard to the way the Government runs its railroads, a correspondent says:—

"I had occasion to visit Prince Edward county, where the only line of railway serving that prosperous farming community is the old C.N.R. line running between Trenton and Picton, now, of course, under Government control. I was obliged to take an early morning train in returning to Toronto from one of the points on the line between Trenton and Picton, and was surprised upon reaching the railway station to find it in complete darkness save for the warm glow of a coal fire which shone from the interior of the waiting room. My friend who accompanied me to the train apologized for the state of darkness surrounding the station-house and explained that it was never open at that time in the morning, and also was rarely open when the eastbound train arrived late at night. People who had come to the station either to meet friends or to see them off, he said, were obliged usually to stand outside in the cold. He also added that freight service had been very bad along that line, he personally having waited over three weeks for a shipment of tin roofing material from the town of Oshawa, and had had no notice up till that time, of the date of its arrival. After entering the train the conductor, upon punching my ticket, inquired if the station at the point where I had boarded the train had been open. When I said "No," he informed me that this condition prevailed all the way along the line between Trenton and Picton, and he said that it involved much extra work for him in issuing tickets to passengers after they had come aboard. I asked him if this state of affairs had existed since the Government had taken over the road, and he admitted, rather hesitatingly, that this was the case."

Now it may not be a fair thing at all to take this case and hold it up as a specimen of the way the Government runs its railways. At the same time there is the germ there that has done much to bring the phrase "civil service" into meaning anything except efficiency and competence.

The Government in the past has been an easy mark to work for in many cases. Salaries were not high, but duties were not very exacting.

It has led to the belief that taking money from the Government was like picking it out of the air, or waving King Midas' magic wand.

Why can't we face this thing as it is, and realize that the people themselves constitute the Government? When they take money and do not give a service commensurate with the amount expended, they are simply taking their own money to plug up the gap and piling up a liability that they must liquidate.

It may be poor management on the part of the Government, and again it may be a lack of real, wholesome honesty and sincerity on the part of the people. The two together make a combination sufficient to hang like a millstone around the financial neck of any national service the Government may undertake to operate.

Chalk production of England is between 4,000,000 and 5,000,000 tons, with an approximate value of 10½ cents per ton. The output for 1913 was 4,458,126 tons, worth £213,479, of which 2,796,857 tons came from the county of Kent.

The New Year Resolution

DID you make any new resolutions for 1920? Perhaps you have made them before, only to break them, but the very fact that you consider it necessary to make a few resolutions is fairly good proof that you've got enough common-sense to see where you fall short of being the man you want to be.

The first of the year is a good time to take stock of yourself. You may imagine you're a dandy. But are you? Be honest. Take a good look at yourself.

It's no trick at all to stand up beside a foot-rule and imagine you're a pretty big man. Neither is it much of a trick to put yourself up against a very average standard of things in general, and juggle yourself into believing that you're not such a bad sort after all.

But get a good, big stick—ten feet long—and stand beside it. Get a high standard of all-round excellence and measure up to it. Then be honest, and if you're a runt, admit it.

Sit down some night, and think the whole thing over. Have you got any particular objective in life? Is the old world better or worse because you have lived in it? Don't hedge or dodge. If you are the man you ought to be you can weigh yourself and see where you fall down.

Remember, the world accepts you largely at your own valuation. In 1920, if you're a dub, the world will accept you at that rating. If you want to be rated as a real man, then play the part.

A Much-Misunderstood Term

TERMS of a semi-technical and semi-commercial nature are in current use, which are very imperfectly understood, even by those who should be absolutely clear on the matter. A typical example of this is much in evidence of late in connection with the Ontario Government's Stationary Engineers' Act. For the purpose of grading certificates of competence, and also of grading the relative importance of different plants, a basic unit of power must be adopted. The natural factor to use is the capacity of the boiler, and this is expressed in terms of boiler horse-power. It is this latter expression which leads to so much confusion.

To the general public, horse-power is a familiar term. They know it as a measurement of their car's capacity. They have heard it spoken of in connection with the locomotive that draws them from town to town, the ship that carries them across the lakes and oceans, the aeroplane, etc. The stationary engineer knows it as a measurement of his engine's capacity. The technical engineer, when he thinks of horse-power, recognizes it as a measurement of the rate of doing work. That is 33,000 foot lbs. of work per minute. When the term is applied to a boiler nobody seems to be very clear as to what it means, and long misuse has clouded the meaning more than necessary.

Both engine and boiler makers found it necessary, when marketing their wares, to have a simple way of explaining their rating to prospective buyers. Engine builders for some time used a rating based on the circular inches in the engine cylinder, and called this nominal horse-power. This was so far from being a measure of the engine's capacity for doing work that it was soon discontinued, and the indicated horse-power rating was adopted. The boiler-maker needing a rating for his wares, designated his boiler as being of so many horse-power. To determine this, a certain number of square feet of heating surface were allotted to produce one horse-power, this number of feet divided into the total heating surface being the boiler rating. This was a step towards a standard, but unfortunately every maker used a different divisor, usually taking one that would give the highest rating to the boiler. Apart from this, the rating did not, and does not convey much meaning to the average commercial user. For instance, two users may have each a 100 H.P. engine. One is compound condensing, and uses 18 lbs. steam per horse-power per hour. The second is an automatic slide-valve and uses 30 to 35 lbs. steam per horse-power per hour. Now, if they go out and ask for a 100 H.P. boiler in the open market one will get a boiler inadequate to his needs. Recognizing this, experiments were made by the American Society of Mechanical Engineers, who determined that a boiler horse-power should be the capacity to evaporate 34½ pounds of water at 212° F. to steam at 212° F. per hour. This is a definite performance, involving the expenditure of a definite amount of heat, which gives a definite amount of energy available, and horse-power is energy expended at a certain rate. Now, obviously as fuel is the medium to supply the heat, the evaporation depends on the amount of fuel burnt per hour. Therefore, if a prospective buyer knows the grate surface he can form a fair idea of the evaporative capacity of the boiler. A very closely approximate rule is to take the area of the grate and multiply it by three. For instance, a 60-inch boiler will have a fire grate 5 x 5, and multiplying by 3, gives 75 H.P. The Ontario Government standard is 34 pounds of water from and at 212° F. per hour. They also give 15 square feet of heating surface per horse-power for a horizontal boiler, and variations from this for other types. However, horse-power, based on heating surface, is only useful as a commercial term. It is the evaporative capacity of the boiler that counts, and, while the heating surface has something to do with this, the amount of fuel that can be burnt per square foot grate per hour is the real governing condition.

A Real Mechanic For a Day

OH, I like a-hangin' round the house the week past Christmas time: the feelin' that camps in my chest is powerful nigh divine. I love that season of the year, by gum, I surely do—it makes me be a kid once more and makes old things come new.

In that there season of the year I get my saw and file. I get my hammer and the glue, I hatch also a smile, and then I gather spikes and tacks, a daub of paint what's red, and tell the kids to come along, I'm fit to go ahead.

And that procesh then starts to come in anguish and in woe; I have to put a spine in new and straighten out a toe—and put a neck beneath a head, and sprout a brand new leg, and make a hen look like as though she'd squat and mold an egg.

And what are all these wondrous things I operate on now—to chase the wrinkle and the scowl from out the childish brow? Why, just the Christmas stream of junk that's built for hours of play—the elephants that thrive an hour, the dolls that live a day.

I put new ears upon the horse, new wheels upon the carts, the Noah's Ark calls forth in grief for sixteen brand new parts.

Oh, in them hours I do rare tricks that sawbones wouldn't try—I carve a leg from out a slab, of beads I mold an eye. Ah, yes, I am a man of parts, smart lookin' to the child; he glories in my stone age craft and in my art so wild. I am a genius for a day, real wheat without the chaff, as I plan new noses for the pigs, new legs for the giraffe.—ARK.

The Italo-American Union, a new trade organization of Italians interested in America, has recently come into existence. It is designed to furnish a centre for all Italo-American committees, and comprises economic, intellectual, art, legislative, and press sections. The National Foreign Trade Council learns that behind it are the big financiers and commercial men of Italy, who hope to encourage commercial and economic relations between the two countries.

The association has obtained the beautiful mediaeval Palazzo Salviati on the Corso Umberto, and will provide there an information office for American business men, a library of American industry, and a central meeting place combining both business and social features.

MARKET DEVELOPMENTS

The Prices Going Up in Some Lines of Steel

Hard Matter to Get Enough to Satisfy the Trade—Scrap Markets Dull Through the Holiday, With Coppers Weak—Large Amount of Business Waiting to be Looked After as Soon as It Can be Handled

AS might be expected, trading is dull during the Christmas season in some lines, but in the main the volume of business that is ready to be taken care of in the machinery, iron and steel markets is large and promising for the coming year.

Probably the most serious problem for the moment is the supplying of the wants of manufacturers who are insistently in the market for sheets, black and galvanized; for plate, bars, tubes, etc. The improvement in the way this material is coming through is very little, if any at all, and it is hard to see where help is coming from. Pittsburgh, according to very reliable reports, looks for nothing like real production until well on in March of 1920. Meanwhile prices continue to rise, not necessarily with the mills, but with the jobbers. Many lines are getting back to where they were when Government control was on, and others are higher than at that time. Mills do not want to take on business. They cannot trust the future sufficiently in regard to production costs, etc., and then there is the desire, perhaps not openly expressed, that the mills shall be in shape to take on business when the prices increase, as they figure they must in some lines at least.

United States Ordnance Department is putting a big list of machine tools on the market here. These were taken from the munition plants in Canada where contracts were held for the U.S. Government. For instance, one Toronto shop and one Montreal shop had between them 600 lathes. Much of the equipment that was strictly single-purpose has been already scrapped. In fact, there is not much war scrap left in the country.

The scrap metal market remains dull. Steel items are the most interesting, and higher prices may be necessary to bring material from those who are holding it. The coppers are weak and may continue so. The companies are going ahead with production, while the export business is not taking anything like the usual amount of material out of United States. The result is that there is too much copper in the market for higher values. This condition is very quickly reflected in the Canadian market.

A YEAR OF UNCERTAINTIES AND OF MEN CHANGING THEIR MINDS

Special to CANADIAN MACHINERY.

PITTSBURGH, December 31.—The pig iron and steel markets have been very quiet the past week, as indeed they have been for a fortnight, thus reflecting the dullness the holiday season always brings. Pig iron prices are stationary, while small lots of some descriptions of finished steel products for early deliveries have brought larger premiums than were ruling. The total tonnage sold at fancy prices is very small in proportion to the large tonnages that have been sold for late deliveries, particularly the second quarter, at either the March 21 prices—the "stabilized" prices —or at slight advances above them.

Indications point to a steadier market in both pig iron and steel products in future. The holiday dullness has given buyers an opportunity to reflect, and in large measure they have gotten over their scare, so that they are not likely to continue the process of bidding the market up on themselves.

The Year 1919

The quietness in the market leaves opportunity for a brief consideration of the year now ended. It was a year of uncertainties and of men changing their minds.

The thought at the beginning of the year, only seven weeks after the armistice had been signed, was that there was a great deal of work for everybody to do, and that conditions would have to be developed whereby they would be in a position to do the work. Necessarily, it seemed, the work left undone was chiefly of a construction character, thus representing investment, and for an investment there must be assurance to the investor that the investment will prove profitable. The investor would not put up a building or factory or power plant if he foresaw that a year or two later he could build the same thing at considerably less cost.

As prices for commodities and rates of wages were vastly higher than before the war, the common thought was that everything would have to be "deflated," just as everything had previously been "inflated" before business in large volume could proceed. The iron and steel industry, fearing that eventually the bottom might drop out of the market, had already made some price reductions, $3 a ton on pig iron and various reductions on finished steel products, which represent an average of a trifle over $4 a net ton on the whole list. It was prepared to make further slight reductions at intervals. There were some in the trade who advocated maintaining the full Government war-control prices on the theory that there would not be much buying in any event.

In February the Government took up the price deflation subject, and Secretary Redfield, of the Department of Commerce, appointed the "Industrial Board," which would deflate and stabilize prices. The board began with the iron and steel industry, arranging for a reduction of $4.25 a ton in pig iron and reductions in finished steel averaging nearly $7 a net ton. The new prices became effective March 21 and are still referred to as "March 21" or "stabilized" or "regular" prices, in the case of unfinished and finished steel, but in pig iron those prices are forgotten since pig iron declined in some instances during the second quarter, while in all districts it advanced sharply in the second half of the year, being now nearly $3 a ton higher than the war-control prices.

The Industrial Board struck a collection of snags. The iron and steel prices were criticized in some quarters on the ground that the reductions were insufficient. The controversy waged largely in the public press between Chairman Peek of the Industrial Board and Director-General of Railroads Hines as to whether or not the deflated prices were low enough, may be passed over in this review for the reason that the gentlemen were simply trying a moot case, because after all the railroad administration had no occasion to make any purchases of steel, at Mr. Peek's prices or any other, that would count for anything.

Another snag the Industrial Board encountered was that other industries would not reduce prices as the iron and steel industry had done. Another, which it ignored for more than a month, was that the Attorney-General had rendered a positive opinion that the whole procedure was illegal.

The Dearth of Orders

Production of steel decreased, until, by the middle of May the iron and steel industry was operating at only about 50 per cent. of its capacity, this comparing with an 87 per cent. operation in January. There was surprise, not that the operating rate dropped to 50 per cent., but that it was so high early in the year that the low point in production was not found until six months after the armistice was signed. The common view before the armistice had been that when hostilities ceased everything would stop.

Many attempts were made to explain why the mills operated as well as they did in the early months of the year. One was that at the time of the armistice there was a great deal of work in progress that was good for peace times as well as war times, even though inaugurated in connection with the war. Another was that certain large steel interests had quietly "reinstated" a large quantity of relatively low-priced business, this being regarded as quite different from cutting the market openly.

Turn in the Tide

It is undesirable to attempt to analyze the complicated economic influences that molded affairs. Suffice it to point out that there was a general swing downwards and then upwards, and the iron and steel industry had to be carried with it. Commodity prices in general, as shown by Bradstreet's index number, declined continuously to about May 1, and then began to advance. Wages did much the same. There were no wholesale wage reductions in the early months of the year, but there were some. Beginning in April or May, wages tended rather to rise than to fall.

Eventually people came to realize that whatever theories or notions they had entertained, prices and wages were not going to fall. Confidence was thereby established, not to a great extent if one consider carefully, but to a sufficient extent to make the country busy. It would have been very unfortunate if "confidence" had been completely restored, for that would have meant the country attempting to do several years of work in a few months. The attempt could not succeed and confusion ruinous to everybody would have resulted.

At the annual convention of the American Federation of Labor held in St. Paul, in June, 1918, it was recognized that the great "open shop" iron and steel industry stood as a bar to any further great progress of the union movement. The convention did not put itself on record as saying so, but the chief consideration, doubtless, was the spectacle presented by the industry of its ability to get along on the open shop principle, and if so, why could not other industries? Accordingly steps were taken to organize the industry. By August, 1919, after some 14 months of work, the organizers found they had done about as much as they could expect. While they had not organized anything like the majority of the men, they had gotten to a point where they could not keep up the excitement except by a strike, for they stood to lose the adherents they had more rapidly than they could expect to gather fresh adherents. Accordingly, the strike was called for September 22 with no demands at all having been made upon the independents, and none upon the Steel Corporation except a request, on the part of the strike leaders, for a "conference" with the chairman of the Steel Corporation.

The strike proved to be chiefly one of common labor, and chiefly the ignorant foreign born labor. It did not touch the ore fields or the Connellsville coke region. As to the remainder of the industry, it rendered idle about 40 per cent. of the men, many of those rendered idle being intimidated rather than being actual strikers. Production was cut about 50 per cent. After the first few days production began to increase by men returning to work, and by the first week in December the strike was practically over except in the Wheeling district. Then came closing of some mills on account of coal shortage, and when coal supplies became available again even the Wheeling district was willing to work.

On the basis of the rate of production just before the strike, a rate of about 83 per cent. of capacity against the 50 per cent. rate at the middle of May and the 87 per cent. rate in January, the strike caused a curtailment of finished rolled steel output of nearly 3,000,000 gross tons, and a curtailment in pig iron of 2,500,000 tons or a trifle more.

The Year's Production

The year's production of finished rolled steel was about 25,000,000 tons, while capacity is about 37,000,000 tons. Thus about one-fourth of the lack of production can be ascribed to the steel strike and about three-fourths to lack of orders. It was certainly ironical that orders should be scarce up to the time of the strike and be all too plentiful, for the market's stability, when the strike was about over.

The "Transitionary" Period

During the war and for some months afterwards there was a great deal of talk about "the transitionary period" during which industry, finance and everything would adjust itself and change for war-time to regular peacetime conditions. The idea is now seen to have been the biggest blunder that could possibly be made. In one way there is no transitionary period and, in another way the world will not be done with its transition in five years or ten years, perhaps not in 15 years. There have been remarkable changes in 1919, falling prices and wages, and then advancing prices and wages, and there will be such changes in 1920 and succeeding years.

POINTS IN WEEK'S MARKETING NOTES

Scrap markets are dull, especially in copper. There seems to be too much copper on the market at present. It is being produced at a high rate, while little of it is being shipped out of the United States.

—

It may be that higher prices will shortly be paid for steel scrap, which constitutes a large part of the scrap business.

—

Everything in sheets is very hard to secure. In galvanized it is almost impossible to get a shipment, and premiums are readily paid for any material that can be secured.

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Montreal, it is reported, has increased seamless and lapwelded tubes 10 per cent., but no advance has been made in Toronto warehouses yet. An increase seems likely, though.

—

A large amount of machinery and equipment is being put on the market by the U. S. Ordnance Department in Canada. This was taken from the shops where U. S. contracts were held.

—

Makers of small tools are being asked for a special price on a fairly large order. Dealers are anxious to see what happens as price shading has been absent from the selling in this district for some weeks past.

—

A large purchase by France of war tools on the U.S. market has cleared the situation there. This order was for $25,000,000, and paid for by ten-year bonds.

—

New York machine tool market says that 1920 is going to be the greatest year yet.

CONDITIONS MUCH LIKE THE WAR YEARS

Deliveries Distant, Prices High, and a Lot of Business are the Features Just Now

TORONTO.—The close of 1919 witnesses a market much the same as the market from 1915 to 1918—the busiest years of the war.

At that time dealers were swamped with business they could not handle. They could only guess at delivery schedules. Now the situation is not much different. Deliveries are not improving. The costs are mounting, and in some lines it begins to look as though the end were not yet in the matter of mounting costs.

Millers, for instance, are due for an increase, according to some of the dealers. They were brought down about 20 per cent. some months ago, and have since been selling on that basis. The reduction was made on the assumption that there would be decreased prices in all machinery lines following the war, but these have not come. No intimation has been given yet on the price of millers, but dealers are expecting something to happen in that direction.

A large quantity of used machinery is being placed on the Canadian market at present by the United States Ordnance Department. One hardly has a conception of the amount of machinery that was put into the munition shops until the lists are looked over showing the amount of machinery that had to be disposed of. Machines that were entirely of the single-purpose variety were scrapped some time ago, and a good many of them went out of the way in this fashion. The steel billets have been cleared out, but there remains about a half-million pounds of copper ingots in the Montreal district, for which sealed tenders are being asked.

The Small Tool Market

Business continues brisk, with bookings satisfactory, and, what seems to please the dealers most of all, there appears to be an absence of price shading in this field. One instance is being noted with some interest. A firm that has a good order to place is trying out the various makers to see if a special price can be secured. As far as CANADIAN MACHINERY can learn, there has been no move made yet to meet this request. The special representatives cannot afford to go below their regular selling schedule, or they would have nothing to come and go on.

Some very nice orders are coming in from a wide range of industries, and, for the holiday season, the dealers are satisfied with the amount of business they are doing.

Steel Markets

Although Toronto dealers have not done so yet, information points to the fact that they have announced a new rate for boiler tubes, which is practically a ten per cent. increase over the last issued schedule. So far, the price has not moved here, and the chances are that, for the present at least, the price will not move, although, when selling has to be done on the basis of replacement of stock, a new schedule will probably be necessary.

A change was made some weeks ago in the manner of pricing cold rolled shafting. The old way was a list price, with a plus or discount. Now there is a base price for mills and jobbers for sizes and quantities. The base at the mills has been $4.95, and from the jobbers $5.50; but the price of $5.75 will probably be nearer what the jobbers are asking.

There is nothing in the way of improvement in the matter of galvanized sheets. They are scarce—very scarce comes nearer to the truth. As far as some cases are concerned, the real situation is that they are not to be had for any price. The 10¾ ounce are priced now at $9; but that price is more or less nominal, as a person who really has to have sheets is apt to pay a pretty stiff premium, and to do so willingly. Although that is the case, it cannot be said that any of the dealers or galvanizers are out to gouge the trade for this particular line, and, as a general rule, they seem to be content to make a fair profit on the deal, especially in view of the difficulty of replenishing the stock in their warehouses.

Sheets, as a general thing, are away back on deliveries. No. 10 are now quoted from the warehouse at $6.50. Blue annealed were fixed by the Government, when Government control was on, at $3.55 for No. 10 gauge. That price was on under war conditions. To-day the price is $4, and the mills are not a bit particular about taking on any more business, as they have more than they can handle, as things stand at the moment.

Scrap Market Dull

There is nothing much moving in the scrap market, and dealers are not looking for any improvement until business gets under way following the holiday season. The steel items are the best in the whole assortment, and the chances are that some higher figures may be necessary in order to induce some of the holders to let go of their material. Steel, of course, is the big end of the scrap market, so far as the ferrous lines are concerned.

Copper, and the rest of the yellows, are weak, and the best guess is that they are going to stay that way for a while yet. The big companies are going ahead and producing copper just as though the export trade were active—while, as a matter of fact, the export business, owing to the exchange rate, is almost a dead letter. There are still some nice lumps of copper in the country from the war contracts. For the time being, there is too much copper in the market to suit the man who wants to make money out of a rise. Of course, this is a condition that would soon right itself were conditions to become normal and the export business to resume.

AMERICAN MACHINE TOOL TRADE LOOKS FORWARD TO GREAT BUSINESS

Special to CANADIAN MACHINERY.

NEW YORK, Dec. 31.—With many machine tool manufacturing plants sold up for three to six months, or longer, and orders still coming in at a very good rate, the American machine tool trade has brighter prospects at the beginning of 1920 than it ever had in its history, with the exception of the war years. The year closes with good business in all lines, many buyers hurrying to get their orders on the books before Jan. 1, when some advances in prices will undoubtedly go into effect.

Throughout the year, the automotive industries have stood out prominently in the buying of machine tools. In fact, without the automotive industries, the machine tool trade might have had a very dull year. At the close of the year, however, manufacturers in many other metal-working lines have begun to place their orders, and the requirements of a goodly number are still to be met in the new year.

Practically all of the automobile companies have bought new equipment in 1919. The total purchases of the General Motors Corporation run into many millions, while orders from $100,000 to $1,000,000 have been placed by other companies in the same field. Outside of the automotive industry, the largest buyers have been the E. W. Bliss Co., Brooklyn, N.Y.; the American Locomotive Co., New York; the American Car and Foundry Co., New York; the General Electric Co., Schenectady, N.Y., which has also bought for new plants at Rochester, N.Y., and Decatur, Ind.; and the Columbia Graphophone Co., Bridgeport, Conn.

Export trade has not maintained the promising start it made early in the year, but the falling off has been due largely to the unfavorable rates of exchange with European countries. Japan, China, and some of the South American countries, have bought fairly well.

While the trade during the early part of the year viewed with grave apprehension the possibility of a flood of used war tools, this factor has now largely been removed from consideration. The French Government will buy $25,000,000 worth of the Government surplus, and a commission is now on its way to the United States to make selections. The tools are to be paid for by 10-year French bonds. Of the remaining tool surplus, there probably will not be

enough high-grade machines to affect the situation seriously. It is significant that the demand for second-hand tools keeps up at a good rate, in spite of the large buying of new tools. The demand for second-hand tools is, in fact, stimulated by the shortage of new tools for prompt delivery.

During the past week, the American Car & Foundry Co. has placed some fairly large orders. The General Electric Co. continues to buy, and orders have been placed for numerous tools by the Neptune Meter Co., New York, C. H. Johannson, Inc., Poughkeepsie, N.Y., and the Poole Engineering & Machine Co., Baltimore, Md. The latter is buying a list of equipment for the manufacture of electric washing machines.

AS HIGH AS 3.25 IS OFFERED FOR PLATES TO SOME INDEPENDENTS

Special to CANADIAN MACHINERY.

MONTREAL, Dec. 31.—There is every prospect of a busy period developing early in the new year, although there is a temporary lull at present, due very largely to the holiday period and the general stock-taking of many firms at this time of the year. Business is taking on an undertone of activity and deferred action in many cases is the inability to get definite assurance of delivery of material. This is particularly true in respect to finished steel lines, and very little betterment is looked for until well into the spring. Business in machine tools has not been very active, but the volume of inquiry is sufficient to maintain the interest of the trade. Delivery of tools from the States is still of uncertain character, and sales of used equipment are frequently made when immediate needs are considered. The old material market is quiet, but the outlook is for a better and firmer market.

Scarcity in Finished Steel

"Shortage of steel lines in every direction," was the remark of a dealer here this week. "Most of the large mills are booked ahead for nearly six months, so there is little hope of relief in the way of steel for some months to come." The larger producers are holding firmly to the price of $2.65 on plates, at mill convenience, but as high as $3.25 has been offered to some of the smaller independents for immediate delivery.

In the case of some of these smaller mills, the bookings are seldom more than two or three weeks ahead, and they are frequently in a position to take advantage of premium offers. Officially, the strike of steel workers is still effective, but the return of many workers has enabled a resumption of operations that is slowly, but gradually, returning the mills to normal activity. Reorganization of employers and departments has resulted in restricted production, and it is roughly estimated that upwards of four million tons of finished steel has been lost in consequence of the strike, and in the face of the present demand it will take some time to overtake this handicap.

The insistent demand for sheets and plates prevents the mill from overtaking it and a marked scarcity of these products is still pronounced. The shortage of black sheets is reflected in galvanized, as the galvanizers are unable to procure sufficient base material to satisfy the trade requirements. Boiler tubes are still hard to get and the market is very firm. Price changes this week are confined to sheets; black 28 being quoted at $7.00, an advance of 45 cents per hundred. Canada dull plates are quoted at $7.65. Premier 28 is quoted at $8.85, a rise of 65 cents per hundred, and 10¾ oz. at $9.25, shows an advance of 75 cents per hundred lbs.

Metals Move Upwards

The non-ferrous situation is affected more by the changes in the States and abroad than by any material altering of local conditions. The market here, as regards sales, shows little change, and demand is quite steady. Exchange rates and the English market are responsible for daily fluctuations in the States, but this is not always reflected here, although it keeps the dealers very active following the movements of the larger interests. Lake copper has advanced to 25 cents, with castings quoted at 24 cents, an advance of ½ cent per lb. The nervous condition of tin is shown in the sharp advance of the week, which is now 65 cents per lb.; this, however, is a nominal figure, and is subject to change from day to day.

There is a fairly good demand for spelter and the quotation of 11½ cents represents an advance of 1½ cents per lb. Lead is also up 1¼ cents and is selling at 9½ cents per lb. Antimony is up a cent at 11½ cents per lb.

Steel Scraps Advancing

There is little to report in the old material situation, as the market is affected by the holiday season and some plants have been operating at low capacity during the past week, so that the requirements for scrap have been lighter than usual, with the feeling that this will continue throughout the present week. Dealers, however, are looking forward to increased demand early in the coming year, and anticipate a stronger market than that now prevailing. With the steel trade gradually getting back to normal in the States, it is expected that better buying will develop before the close of January. All metals are moving slowly with quotations on non-ferrous quite firm. Iron and steel scraps are taking on strength and prices are advancing. Advances range from $1 to $7 per ton, malleable scrap taking on this last advance. Wrought iron axles are quoted at $25, an advance of $5 per ton. Revised prices will be found in the selected market quotations.

U.S. SCRAP METAL

The demand for scrap is showing improvement which is a reflex of the improved coal situation. There have been some price advances. Following are reports from various sources:

ST. LOUIS.—There has been a general advance in prices from $1 to $3.50 for all grades. Old car wheels have gone to $28.50 and $29. There is a very confident feeling in the market due to a good general demand and a marked scarcity of material.

NEW YORK.—Foundries are buying scrap freely without question of price. No. 1 heavy machinery is quoted $27 to $28 f.o.b. New York. City wrought pipe, long stock, is $21.50 to $22.50 f.o.b. New York. Machinery cast is $29 to $30. Heavy melting is unchanged but firm.

PHILADELPHIA.—There have been good purchases of heavy steel scrap, blast furnace borings and turnings and machine shop turnings. Heavy steel scrap brought $22 delivered, which is not considered high. No. 1 cupola has sold to $35 delivered.

PITTSBURGH. — The steel making grades are very firm, heavy melting being quoted at $25 delivered. Machine shop turnings are quoted at $16, a rise of $1. Low phosphorus steel is $30 delivered.

BUFFALO.—There is little trading, everybody evidently waiting for the New Year. Prices, while quoted higher, are really nominal.

BIRMINGHAM.—There has been no change in prices, although the tendency is for them to go up. Contracts are being made, and some grades are getting scarce. Heavy melting steel is still held too high by the dealers to interest consumers.

CHICAGO.—There is a generally firm feeling in the market. Mills producing bar iron are getting into operation again, and this has helped the demand for wrought scrap and bushellings. There is a better demand for steel-making grades.

BOSTON.—The market is quiet, the only grade shewing activity being cast scrap. As high as $36.50 has been obtained for mixed railroad and machinery scrap. Heavy melting steel and turnings are quiet.

CLEVELAND.—There is little doing here as far as consumers are concerned. Dealers are doing some speculative buying, offering in some cases considerably higher than the market. Other dealers are sitting tight, neither buying nor selling. Prices remain the same generally.

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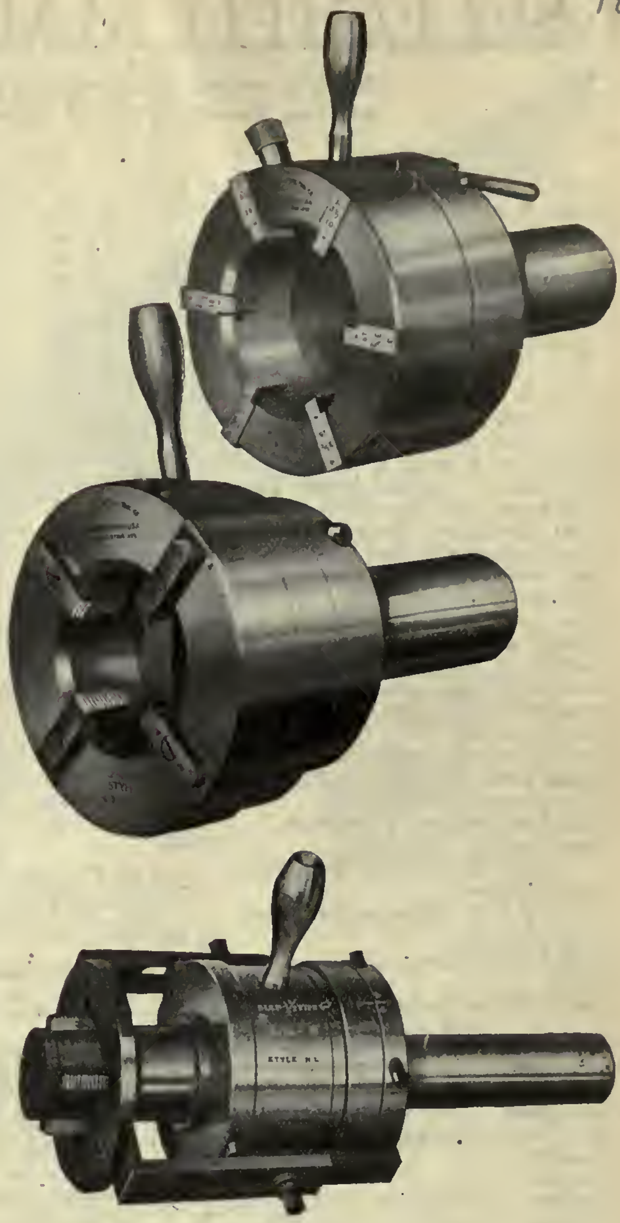
A GOOD BOON

"Geometric Tools are a good boon in our business. Always reliable and sure of turning out a class job; in fact, I don't know how we could secure a decent output without them."

This is what the Works Inspector of a London (England) shop says. He adds that they are making screw and small parts for air craft, and have quite a lot of Geometric Dies in constant use.



Because of the fact that Geometric threading tools are "a good boon" in the thread cutting business, the majority of screw machines and turret lathes are equipped with Geometrics.

THE GEOMETRIC TOOL CO.
NEW HAVEN, CONN.

Canadian Agents:

Williams & Wilson, Ltd., Montreal
The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg and St. John, N.B.
Canadian Fairbanks-Morse Co., Ltd., Manitoba, Saskatchewan, Alberta

For any thread, any size, any pitch — there's a Geometric Collapsing Tap or Self-Opening Die Head. Be assured there is one to meet your particular threading need — whatever it may be. Ask us.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$33 00
Lake Superior, charcoal, Chicago	38 40
Standard low phos., Philadelphia	40 00-40 00
Bessemer, Pittsburgh	35 00
Basic, Valley furnace	30 00

Toronto price:—
Silicon..2.25% to 2.75% $37.00 to $40.00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 4 25
Steel bars, base, Toronto	4 25
Steel bars, 2 in. to 4 in. base	5 50
Steel bars, 4 in. and larger base	6 00
Iron bars, base, Montreal	3 75
Steel bars, base, Montreal	3 75
Reinforcing bars, base	4 50
Steel hoops	6 00
Norway iron	11 00
Tire steel	5 50
Spring steel	8 00
Band steel, No. 10 gauge, base	4 40
Chequered floor plate, 3-16 in.	7 50
Chequered floor plate, ¼ in.	7 00
Staybolt iron	8 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	2 35
Tank plates, Pittsburgh	2 65
Structural shapes, Pittsburgh	2 45
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 90
Small shapes under 3"	3 62

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points	C.L.	L.C.L.
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

		Gross.
Lake copper	$25 00	$24 00
Electro copper	24 00	24 00
Castings, copper	24 00	24 00
Tin	65 00	60 00
Spelter	11 50	10 75
Lead	9 50	8 75
Antimony	11 50	10 50
Aluminum	33 00	35 00

Prices per 100 lbs.

PLATES

	Montreal	Toronto
Plates, ¼ up	$ 5 00	$ 5 00
Plates, 3-16 in.	5 25	5 25

Price List No. 38

WROUGHT PIPES

Standard Buttweld

⅛ in.	$ 6 00	$ 8 00
¼ in.	4 68	6 81
⅜ in.	4 68	6 81
½ in.	6 21	7 78
¾ in.	7 82	9 95
1 in.	11 56	14 71
1¼ in.	15 64	19 90
1½ in.	18 70	23 76
2 in.	25 16	32 01
2½ in.	40 37	51 19
3 in.	52 79	66 94
3½ in.	67 16	84 18
4 in.	79 57	99 74

Standard Lapweld

2 in.	38 81	35 34
2½ in.	42 12	52 36
3 in.	55 08	68 47
3½ in.	69 00	86 94
4 in.	81 75	103 00
4½ in.	93	1 18
5 in.	1 08	1 37
6 in.	1 40	1 78
7 in.	1 83	2 32
8L in.	1 93	2 44
8 in.	2 22	2 81
9 in.	2 66	3 36
10L in.	2 46	3 12
10 in.	3 17	4 02

Terms 2% 30 days, approved credit.

Freight equalized on Chatham, Guelph, Hamilton, London, Montreal, Toronto, Welland.

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.
4½" and larger 50%.
4" and under, running thread, 30%.
Standard couplings, 4" and under, 40%, 4½" and larger, 20%.

OLD MATERIAL

Dealers' Average Buying Prices.

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$14 00	13 75
Copper, crucible	17 00	17 00
Copper, heavy	17 00	17 00
Copper wire	17 00	17 00
No. 1 machine composition	15 25	16 00
New brass cuttings	11 00	10 75
Red brass cuttings	14 00	14 75
Yellow brass turnings	8 00	9 00
Light brass	6 25	7 00
Medium brass	7 25	7 75
Scrap zinc	6 00	6 00
Heavy lead	5 00	6 00
Tea lead	3 75	3 50
Aluminum	18 00	18 00
	Per Ton	Gross
Heavy melting steel	15 00	16 00
Boiler plate	15 00	11 00
Axles (wrought iron)	25 00	20 00
Rails (scrap)	16 00	16 00
Malleable scrap	25 00	20 00
No. 1 machine cast iron	24 00	25 00
Pipe, wrought	10 00	9 00
Car wheels	22 00	20 00
Steel Axles	21 00	20 00
Mach. shop turnings	9 00	11 00
Stove plate	22 00	21 00
Cast boring	10 00	11 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜" and less	15
Carriage bolts, 7-16 and up	Net
Coach and lag screws	30
Stove bolts	50
Wrought washers	50
Elevator bolts	5
Machine bolts, 7-16 and over	10
Machine bolts, ⅜" and less	20
Blank bolts	25
Bolt ends	10
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square blank	add $1.50
Nuts, square, tapped	add 1 75
Nuts, hex., blank	add 1 75
Nuts, hex., tapped	add 2 00
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	40
Sq. and Hex. Head Cap Screws	35
Rd. and Fil. Head Cap Screws	5
Flat But. Hd. Cap Screws	10
Fin. and Semi-fin. nuts up to 1 in.	35
Fin. and Semi-fin. nuts, over 1 in., up to 1½ in.	25
Fin. and Semi-fin. nuts over 1½ in., up to 2 in.	10
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws list plus 20,	30
Thumb screws	40
Thumb nuts	75
Patch bolts add	20
Cold pressed nuts to 1½ in. add	$1 00
Cold pressed nuts over 1½ in. add	2 00

BILLETS

	Per gross ton
Bessemer billets	$43 00
Open-hearth billets	43 00
O.H. sheet bars	46 00
Forging billets	56 00
Wire rods	55 00

Government prices.
F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$4 95
Cut nails	5 00
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 32
British Manila rope	0 26
New Zealand hemp	0 26
Transmission rope, Manila	0 43
Cotton rope, ¼-in. and up	0 80

POLISHED DRILL ROD

Discount off list. Montreal and Toronto .... net

MISCELLANEOUS

Solder, strictly	$ 0 34
Solder, guaranteed	0 39
Babbitt metals	18 to 70
Soldering coppers, lb.	0 58
Lead wool, per lb.	0 14
Putty, 100-lb. drums	6 75
White lead, pure, cwt.	17 80
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English	0 35
Tarred slater's paper, roll	1 30
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls., gal.	1 50
Linseed oil, raw, single bbls.	2 90
Linseed oil, boiled, single bbls.	2 92
Plaster Paris, per bbl.	4 50
Sandpaper, B. & A.	List plus 43
Emery cloth	List plus 37½
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 07
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 50

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes up to 52	40
S.S. drills, wire sizes, No. 53 to 80	40-10-5
Standard drills, all sizes	40-10-5
3-fluted drills, plus	10
Jobbers' and letter sizes	40-10-5
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	net
Drills and countersinks	5% off
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus 20 to	40
Canadian high speed cutters, net to	10 off
American	plus 40

COLD ROLLED SHAFTING

At mill	list plus 5%
At warehouse	list plus 25%

Discounts off new list. Warehouse price at Montreal and Toronto

IRON PIPE FITTINGS

Malleable fittings, class A, 20% on list; class B and C, net list. Cast iron fittings, 15% off list. Malleable bushings, 25 and 7½%; cast bushings, 25%; unions, 45%; plugs, 20% off list. Net prices malleable fittings; class B black, 24½c lb.; class C black, 15¾c lb.; galvanized, class B, 34c lb.; class C, 24½c lb. F.O.B. Toronto.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 7 00	$ 6 75
Sheets, black, No. 10	6 50	6 50
Canada plates, dull, 52 sheets	8 50	8 00
Can. plates, all bright	8 50	9 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	....	....
Fleur-de-Lis, 28 B.W.G.	....	....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28	....	....
Premier, No. 28, U.S.	....	8 60
Premier, 10¾ oz.	....	9 00
Zinc sheets	20 00	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅝ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 00	.....
1½ in.	30 00	26 50
1¾ in.	32 00	26 50
2 in.	31 00	26 00
2¼ in.	35 00	28 00
2½ in.	43 00	32 00
3 in.	48 00	40 00
3½ in.	.....	41 00
3½ in.	60 00	42 00
4 in.	75 00	56 00

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	24½
Palacine	24½
Machine oil, per gal.	36
Black oil, per gal.	15
Cylinder oil, Capital	58
Cylinder oil, Acme	45
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	$2 60
Union thread cutting oil, antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil, bbls. net	8

BELTING—No 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30, 10%
Cut leather lacing, No. 1	2 20
Leather in sides	1 75

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	4 00
Polishing wheels, bull-neck	2 25
Emery in kegs, American	06
Pumice, ground	06
Emery glue	35
Tripoli composition	09
Crocus composition	12
Emery composition	10
Rouge, silver	50
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE

XXX Extra	19½	Atlas	17
Peerless	19	X Empire	15½
Grand	18	Ideal	16
Superior	18	X Press	14
X L C R	17		

Colored

Lion	15	Popular	12
Standard	13½	Keen	10½
No. 1	13½		

Wool Packing

Arrow	25	Anvil	15
Axle	20	Anchor	11

Washed Wipers

Select White	.11	Dark colored	.09
Mixed colored	.10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades... 15%

ANODES

Nickel	.58 to .65
Copper	.38 to .45
Tin	.70 to .70
Zinc	.18 to .18

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6 x 4 base	45 00	44 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 75	$11 50
Sheets, 3½ lbs. sq. ft.	10 50	11 00
Sheets, 4 to 6 lbs. sq. ft.	10 25	10 50

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .25
Acid, yhdrochloric	.04
Acid, nitric	.10
Acid, sulphuric	.04
Ammonia, aqua	.13
Ammonium, carbonate	.20
Ammonium, chloride	.22
Ammonium hydrosulpuret	.50
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, annhy	.41
Copper, sulphate	.16
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulpate	.16
Nickel carbonate	.32
Nickel sulpate	.18½
Potassium carbonate	.50
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.25
Silver nitrate (per oz.)	1.20
Sodium bisulphate	.18
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.18
Tin chloride	1.75
Zinc chloride, C.P.	.30
Xinc sulphate	.08

Prices per lb. unless otherwise stated

The Iron and Steel of British Columbia

Efforts Are Being Made to Have a Basic Industry Established on the Pacific Coast Coast—Many Considerations Have to be Weighed Before Making a Start

THE possibilities of developing a steel industry in British Columbia are dealt with at considerable length in the annual report of the Research Council. Many things have to be considered, and the report leaves the impression that further research work will be necessary before definite findings would be possible.

On March 22, says the report, there was submitted to the Minister of Mines at Ottawa a memo from a delegation from British Columbia in which is set forth an argument for the establishment of an iron and steel industry in British Columbia. Copy of this is attached. While this memo sets forth clearly the benefits which would ensue if an iron and steel industry could be established in British Columbia, it brings forward no evidence to show that there has been any sufficient development of the ore bodies in British Columbia on which can be based data for the establishment of an iron and steel industry, or that there is any sufficient data of any kind upon which to base the formation of such an industry.

It is clear that a very great deal of expensive investigation will have to be undertaken before any practical consideration can be given to the establishment of the iron and steel industry on a large scale.

The first thing to be done is to determine the extent and nature of the available ore bodies, and any aid that can be given either by the Provincial or the Dominion Government to this work will doubtless produce valuable results.

Such work, however, would take a long time even if a very large sum of money were immediately available, and in the meantime the iron and steel industry in British Columbia can only be expected to start from small beginnings and gradually to grow to larger things.

The most likely direction in which immediate progress can be made is in electric smelting.

The Present Capacity

There is at the present time only one electric furnace in British Columbia. This is a 5-ton, 3-phase, furnace established at the Port Moody Steel Works by the Aetna Iron and Steel Co., and now being operated by the Columbia Iron and Steel Co. This furnace has been in operation since the end of May. It is producing pig iron from ordinary scrap and the product is being exported to Japan at a price of about $70 per ton. So far the maximum production in any month has been 380 tons, but it is hoped that a steady production of 500 tons per month can be obtained.

The use of an electric steel furnace for such a purpose is clearly only justified by war prices, and high grade steel instead of cast iron will have to be produced after the war.

There is at present no electric steel casting furnace in British Columbia, and in this respect Vancouver is badly behind the times. There is only one steel foundry in Vancouver, and while this is doing good work its product cannot approach the product of the electric steel furnace for castings.

Negotiations are under way, if not concluded for the establishment of a second electric furnace for the production of pig iron, using part scrap and part ore.

The existing power companies can sell power for melting steel in electric furnaces at a remunerative price which costs the producer about $6 per ton of product for the power used. The amount of power, however, which is required for smelting iron ore is three times as great as is required for melting, and the product for the "after the war" market could not possibly stand a price for power of $6 per ton. On the other hand the existing power supply companies, having been built for general light, power, and street railway purposes, cannot sell power remuneratively at the low price required for smelting iron ore under the conditions of electric smelting which have prevailed up to the present time.

If a high grade steel can be produced in one process directly from the ore, as is being done in the experimental furnace of Dr. Robert in Seattle, it is possible that the electric furnace could pay a price for power which would be remunerative to the existing power companies.

If a process can be made commercially successful whereby the preliminary reduction of the ores can be carried out by reducing gases at low temperature, and reduction can be furnished in the electric furnace, the amount of power required per ton of product will be so greatly reduced that the existing power companies will be able to sell power for electric smelting, on a small scale, at prices which would make smelting profitable. Furnaces of small capacity could then be established at various convenient points in British Columbia.

If, however, electric power amounting to around 2,000 kw.h. per ton of product is required for smelting purposes, then it would appear that some one of the numerous power sites on the British Columbia coast will eventually have to be developed for this special purpose.

There are a number of sites on Vancouver Island, and along the coast between Vancouver and Prince Rupert, where power can be developed as economically (considering differences in cost of material and labor), as any power development that has been made in Norway or Sweden. These power sites are situated at tide water where ore, limestone, coke and other raw materials can be delivered at low cost, and the product can be shipped from the works in ocean-going vessels at any time of the year.

Such power, however, cannot generally be economically developed unless the plant is built to the fullest capacity at the start. This usually involves an investment that is too large for any small commercial undertaking. If, however, there could be established a group of industries for the electric smelting of iron, ferro-manganese and other metal products, for the production of nitrates, calcium carbide and other electro-chemical products a sufficient demand for power would be created to make it possible to take full advantage of the economical value of the power sites along this coast.

It appears to be quite possible that such an undertaking might be commercially successful either under war, or after the war, conditions, and it is suggested that further investigations along these lines would be of value.

That normal transatlantic shipping is not yet an accomplished fact is shown by the recent announcement of the British Ministry of Shipping regarding the early 1920 sailings to the West Indies, that had been arranged by the White Star-Dominion Line. The SS. Megantic was to have been placed on this route for a number of pleasure cruises, but the powers-that-be have seen fit to decide otherwise, and this vessel will remain on her regular route throughout the winter to assist in relieving the heavy service that is expected during the next six months.

T. W. Rogers has joined the staff of the St. Lawrence Welding Company, of Montreal, and will have the position of general sales manager for the company. Prior to his recent appointment, Mr. Rogers was eight years with Darling Bros., four years as a travelling salesman and the last four as purchasing agent. He was formerly with the heating division of Taylor, Forbes Co. The tank development of the St. Lawrence Welding Company will necessitate additional selling organization, and Mr. Rogers will have full charge of this department.

A St. Paul man has invented a fan for barber shops to carry advertisements and be hung where a patron can read them while he is in a chair, at the same time being within easy reach of a barber.

CANADIAN MACHINERY
AND
MANUFACTURING NEWS

19

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1920 Will Be What You Make It

LET us start out with the idea of making 1920 a better year than 1919. From many angles the year just closed has been a mistake. Industrially it has been a nightmare.

Following the war we looked for more humanity in industry and we have looked in vain. The details of the peace treaty had not been signed when Capital and Labor were ready in Canada to stage a contest that was as bitter as it was unnecessary.

The man in the shop is human. Don't use him as a bit of material. He will respond to an incentive, but he will not be driven.

The man in the shop does not like to feel that the only notice taken of him is when his metal tag shows him late or absent.

Now, in all seriousness get away from the idea that you can "run your men" on the card index system.

Remember, each of those metal numbers represents a man—in many cases a married man. Follow along. It represents a home, a family—it represents disappointment or joy, hopes and aspirations along sane and proper lines, or else it represents a discontented mind, ripe for the teaching of the extremist and tilled for the seed of revolution.

By all means have your shop efficient, but take care not to efficiency-expert all the ambition and genius out of your men.

The shop that is efficiency-experted to death is hanging out a streamer calling upon the labor leader to come along and do his worst.

Don't say you have so many men in your plant that you don't know them personally. The man on the machine or on the bench likes to know the man or men he is working for. You'll be surprised how many of them you can know if you set seriously to the task.

There are manufacturers who have their happiest moments putting across plans to make life worth living for the men who are turning out the work for them.

There have been manufacturers whose death has been the signal for an open celebration among the men at the works.

These are absolute facts, and you can put yourself largely in the class of your own choosing.

The man in the shop should watch out for the agitator. He should watch out for the man who makes money out of strikes.

Strike pay at best is a joke when stacked up against the cost of living at the present time.

If you have a grievance, make sure it's a real one. If it is, get busy and take it up with the proper parties.

If your supposed grievance is only a grouch, forget it. If you keep on nursing the thing it will spoil you.

If you have a good place to work, help to keep it in that state. Don't make yourself the excuse for calling in the efficiency engineer.

The strike should be the last resort. There have been times when men could not honorably take any other course. But don't let the agitator do your thinking for you.

Grow a big crop of common-sense in 1920, both in the office and the shop. Rehashing old scores is the pastime of fools.

Keep the office close to the shop, not in actual feet and yards, but in sincerity of purpose, frankness of dealing and honesty of endeavor.

There are greater things in the world than piling up dividends, and more worthy objects than earning the mercenary plaudits of shareholders.

Put yourself—manager and mechanic—in the other fellow's position now and then. It broadens the vision and irons out a whole lot of picayune conceptions.

Give 1920 a better chance than you gave 1919. A little give-and-take is good for both ends of the business. No one side to a controversy ever had a monopoly of all the good points.

1919 Was a Period of *Growth* and *Expansion*

Reports From Industrial Centres Tell a Story of Progress and Growth—Old Plants Enlarging and New Ones Entering the Field for the First Time

THE year just closed was not the blue ruin period of time that was supposed to follow on the heels of the armistice. Canadian industries had a busy time. They were building extensions and taking on more men, buying equipment and looking about for improved methods for speeding up operations in all branches.

The markets of the world were depleted—sadly so. There was a great chance to sell almost anything that the shops could or would turn out. Strikes and labor troubles hurt business early in the season, and shortage of material since then has not helped matters. But the industrial centres of the Dominion have gone ahead in a remarkable way, as the following resume will show. CANADIAN MACHINERY is indebted largely to the secretaries of Boards of Trade and Chambers of Commerce for the information on these pages:

Growing in Spite of Strike

WINNIPEG.—Building in Winnipeg was hampered to a great extent on account of the general strike, covering a period of nearly seven weeks. Many contemplated additions to industrial plants have, as a result, been held over until the beginning of 1920. Indications are that the new year will see a resumption of building in this city on a very large scale.

Following are completed or under way:

Western Wheel and Foundry Co., plant covering 15 acres in St. Boniface, across the river from Winnipeg, $75,000; City Light and Power Dept., show-room, $42,000; R. S. Robinson, warehouse, $60,000; Allen Theatre, $200,000; Reliance Ink Co, warehouse, $8,000; J. H. Parkhill, bedding factory, $49,000; Alaska Bedding Co., factory additions, $26,800; Brett Mfg. Co., factory, $20,000; Chevrolet Motor Co., sales-rooms, $23,000; Bemis Bag Co., warehouse add., $25,000; Manitoba Government Telephones, additions, $51,200; Quinton Dye Works, additions, $30,000; Manitoba Creamery, additions, $10,000; Northland Knitting Co., factory addition, $24,000; J. K. L. Ross, garage, $50,000; Weidman Bros., factory addition, $9,000; Ames-Holden-McCready, warehouse, $60,000; University of Manitoba, institution, $85,000; Canadian Fairbanks Morse Co., warehouse, $10,000; Rumley Mfg. Co., warehouse addition, $40,000; V. Rubin, factory, $7,000; Twin City Separator Co., warehouse, $21,000.

New bank branches:—Bank of Commerce, $68,000; Merchants Bank, $29,500; Union Bank of Canada, $37,000.

School additions, $142,000.

Everything points to a banner year for residential building in the City of Winnipeg in 1920. Applications for loans under Winnipeg's Housing Scheme are being received at the rate of five a day. A permit has just been issued for another new theatre, costing nearly half a million dollars. Marshall Wells, wholesale hardware company, are erecting a warehouse on the east side of the Red River, which will cost $175,000.

Five New Ones in Guelph

GUELPH.—Five new industries have commenced operations in Guelph:

(1) The Shinn Mfg. Co., automobile wire and lightning protection. This is a branch of an American concern.

(2) The Northern Rubber Co.—A new reinforced concrete building, four stories in height. Cost of building, $150,000. Total investment, $500,000. Number of employees when completed and in operation, 500. Will make rubber footwear.

(3) Lang Mfg. Co., manufacturers of special machinery and garden seats. Purchased an existing building and enlarged it, $20,000.

(4) Live Wire Co., manufacturers of insulated rubber wire. (Branch of an American Co.), $100,000.

(5) Flax Spinners, Ltd., linen, yarns and threads, $50,000.

The following firms have erected additions:

Partridge Rubber Co., $150,000 expenditure, four stories.

Guelph Carpet and Worsted Spinning Mills, a $400,000 new addition, including a new reinforced concrete four-storey building, and additions to the existing plant.

The Sterling Rubber Co., a new addition, being the first of several units planned, cost $15,000.

Taylor-Forbes Co., additions to the foundries, $20,000.

Dominion Linens, Ltd., $20,000 addition.

International Malleable Iron Co., new pipe-fitting works, total investment, $100,000.

Gilson Mfg. Co., new addition, $15,000.

White Sewing Machine Co., new addition, $20,000.

Sherer-Gillett Co., new building and additions, $25,000.

The building operations at Guelph at the present time are abnormally active, due to the above-named additions and improvements, and also to the big housing expansion now going on. A new school, $80,000; skating rink, $50,000; and several very large additions to the Ontario Agricultural College are now being carried to completion.

Stratford Has Busy Year

STRATFORD.—The close of the year 1919 finds Stratford in a very healthy condition industrially. Stratford is pre-eminently a wood-working centre, and our furniture factories are all taxed to capacity in an effort to meet the unprecedented demand for their output.

The phonograph division of the McLagan Furniture Company, Limited, has assumed large proportions and even larger growth is looked for during the coming year. The Kindel Bed Company, Limited, who moved to Stratford from Toronto in 1916, are erecting an addition 75 ft. x 185 ft., three storeys and basement, this addition being necessitated by the rapid increase in their business since moving here.

Stratford has acquired two splendid industries this fall. The first is the Canadian Edison Electric Appliance Company, Limited, who have purchased the Mooney plant with 120,000 feet of floor space. They will manufacture electric household appliances of all kinds, and it is expected that this industry will develop into one of the most important ones in the city.

The Grosch Felt Shoe Company, Limited, of Milverton, have purchased this week the Stratford Desk Company plant with 25,000 feet of floor space, and will begin the manufacture of felt shoes early in the year. Their business has been making such strides that the Milverton plant could no longer supply the demand, and it is expected that both plants will be operated to capacity.

Practically all other lines in the city have all the business on hand they can well look after, and the year has been a prosperous one for our industries.

Established Firms Expanding

ST. CATHARINES.—The industrial growth of the city of St. Catharines and surrounding district during the past year has been, considering the conditions that have existed, very encouraging. Two new industries have been located here, and while operations are being confined to a few lines at present, it is the intention of these concerns to gradually add other lines to their product, and there is every prospect that they will very rapidly develop into industries of considerable magnitude.

The principal industrial development, however, that has taken place in this district during the past year, is the large increase in the capacity of the majority of the well-established industries. One of the largest concerns has added many new lines to their product which will practically double their capacity. Another company has purchased a site for the erection of a new factory, which will enable them to triple their output, while several others are building additions to their plants in order to take care of the increased demand in their different lines.

In so far as the industrial future of St. Catharines is concerned, with its many natural advantages, such as an abundance of cheap electric power, rail and water transportation facilities, high-grade labor market, close proximity to large centres, etc., together with the added advantages of being located adjacent to the New Welland Ship Canal now under construction, and within a few miles of the 300,000 h.p. electrical development at Queenston, there is every prospect that this city will eventually become the centre of one of the largest industrial sections in the Dominion.

Niagara Falls Gets Big One

NIAGARA FALLS.—The industrial activities in the city as suggested by new factories are:

A new brick building for the Niagara Wire Weaving Co., Ltd. The building is well along towards completion and will represent an investment of $220,000. They will employ about 150 hands, and the product will be wire-weaving machinery and wire cloth, to be used largely in pulp and paper mills.

The Carbon Alloy Steel Co. have purchased a site and broken ground for a large factory adjacent to our city. They will soon be in a position to give more particulars as to proposed output, etc.

The American Can Company have enlarged their plant by taking over the premises formerly occupied by the Thompson and Norris Co.

Prospects for American manufacturers locating branches here in the near future are bright, being attracted by the unique power situation. Located as we are at the very source of power development, we are able to furnish comparatively cheap energy and avoid all transmission difficulties.

New Industries at Belleville

BELLEVILLE.—Distinct and material progress has been made during 1919, not merely in the addition to our population, but also by the establishment of several new industries, such as:

The Judge Jones Milling Company, Limited (Dominion charter).

The Elliott Woodworking Machinery Company.

The Teco Manufacturing Company (Pancake Flour, etc.)

The Weed Harvester Company, Limited.

W. A. Wood Valve Company.

The Peaso Company, Limited.

The building permits have, in spite of the excessive price of materials and labor, been very satisfactory, and the council have adopted the Housing Scheme. The new Albert College will break ground next year. There is also to be a new Public School, and the new main building of the Ontario School for the Deaf has actually been commenced. The C.P.R. freight sheds are in course of construction. Everything points to a prosperous and progressive 1920.

Peterborough's New Industries

PETERBOROUGH.—The new industries in Peterborough this year include:—

The Western Clock Co., of La Salle, Ill., makers of the well-known Westclox line of clocks and watches. This company has purchased a building on George Street South, 80 x 23 feet, three storeys and basement, which it will occupy this month. In the meantime they are occupying space in the Barrie building and are building up their organization, and expect to have 200 hands employed within a year.

The Albion Knitting Co. leased, with an option to purchase, a building on Park street, 35 x 55 feet, two storeys, and are making good progress in building up a staff and business.

The Bon Marché Manufacturing Co. was organized and leased premises on Simcoe street, and is engaged in the manufacture of whitewear.

The Nashua Gummed & Coated Paper Co., of Nashua, N.H., have leased the premises on Aylmer street which had been used by the Renfrew Manufacturing Co. for a munition factory. There is in the building 40,000 square feet of factory space, besides a warehouse, 348 x 50 feet, and an office building, 30 x 48 feet, two storeys. Improvements are being made in the building and the company expects to begin manufacturing operations before the end of the year.

The Canadian Aladdin Co. has arranged with the city for a site of about six acres on the Monaghan Road, and will erect a building 100 x 200 feet, and invest $70,000 in building and plant for the manufacture of their ready-cut houses.

Alexander Stewart has put up two buildings on Gladstone avenue, 40 x 20 feet and 30 x 15 feet, for a wool stock factory.

Several of the established factories have enlarged their space.

The Canadian Woollens, Limited, are erecting a factory building at their Bonner-Worth plant on McDonnell street, 114 x 56 feet, three storeys and basement, at a cost of $40,000.

At their Auburn factory on Auburn street, Canadian Woollens, Ltd., are putting up an addition to provide additional weaving space, 140 x 70, one storey and basement, at a cost of $35,000.

On McDonnell street, also, Canadian Woollens, Ltd., are erecting an office building, 66 ft. 4 in. x 37 ft. 6 in., two storeys and basement, which will cost $10,000.

The Alfred McDonald Lumber Co. are erecting a building, 50 x 50 feet, on Rink street for a box factory, to enable them to increase their output in this line, as well as to give more space in their planing mill and sash and door factory.

The Canadian Chicle Co. purchased a building, 115 x 40 feet, on Rink street and are enlarging it into a three-storey building and otherwise improving it for their growing business at a cost of $8,000 to $10,000.

The DeLaval Co. put up a storage shed, 112 x 32 feet, and Turner Bros. a similar building, 40 ft. x 27 ft. 6 in.

The Peterborough Cereal Co. completed ten concrete elevators and the enlargement of their cereal mill, by adding a storey on the mill and additions, begun last year.

Kitchener Keeps on Growing

KITCHENER.—The year 1919 has been one of very marked industrial activity and expansion in Kitchener. Quite the most important accession to new industries is the Ames-Holden-McCready System, who are erecting a million dollar automobile tire plant here and expect to be turning out tires early in the new year. The A.-H.-M. people are also building a large factory for manufacture of felt footwear and commercial felts. It is expected to be turning out finished product by

February 1 next. This felt factory and equipment is costing about $150,000.

The Dominion Tire Company has met with uninterrupted success and have brought their daily output of tires from 1,200 to 2,100. The factory is being enlarged to double its present capacity and by early spring the output will be again doubled. The company is spending about half a million dollars on expansion.

A new industry with great possibilities that has come to Kitchener this year is the Four Wheel Drive Auto Company, starting with a capitalization of $200,000. This is the Canadian branch of the parent company at Clintonville, Wis., and the Canadian plant will supply not only the home demand for these trucks, but, as well, look after the foreign demand. A factory site has been located beside the railway and building operations are well advanced.

The Kitchener Buttons, Ltd., were obliged to add four stories, 40 ft. x 50 ft., to their already large factory, spending about $50,000 on enlargements. The Lang Tanning Company, which, near the end of last year, embarked upon the manufacture of sole leather, in addition to their big harness leather industry, have steadily expanded this year. Some large additions have been made to their immense plant and but for the difficulty in obtaining materials and shortage of labor, much more would have been done. Their expenditures on new buildings and equipment this year will approximate $35,000.

The Pollock Manufacturing Company, makers of phonograprs and accessories, was recently amalgamated with the General Phonograph Corporation of Canada, Ltd., and considerable expansion is already indicated. An addition to their factory, 65 ft. by 100 ft., is nearing completion.

The Greb Shoe Company, Ltd., makers of men's shoes, have removed to new premises, giving them more than double former floor space, and they now occupy a splendidly built factory, 56 ft. by 100 ft., three storeys and basement. When in full running order this company's present daily output of 300 pairs will be increased to a minimum of 1,000 pairs.

The Merchants Rubber Company felt the effects of increased activity and added a four-storey and basement building to their plant, giving them some $5,000 square feet of additional floor space. Approximately $60,000 was expended on building and equipment.

A. & C. Boehmer, paper box makers, are building a wing to their factory, which will cost about $10,000.

The Mitchell Button Company, organized only four years ago, found it necessary to secure larger quarters last fall and now have a modern and efficient plant, working to capacity. They spent some $15,000 on expansions.

Among the new industries which have become established in the past few months are Watson & Kilby, makers of child's bootees, and the Kitchener Envelope Company, Ltd., the latter located in the premises vacated by the Mitchell Buttons.

The John Forsyth Company, manufacturers of fine shirts and underwear, have opened an additional facory in the adjoining town of Waterloo.

Baetz Brothers Furniture Company have taken two floors of the premises formerly occupied by Star Whitewear Company, and are engaging in the manufacture of furniture specialties.

The Twin City Oil Company have gone into the manufacture of grain crushers upon a larger scale and are also manufacturing gasoline measuring tanks, and put up a large addition to their premises for manufacturing purposes, spending about $10,000 on buildings and machinery.

St. John's Immense Dry Dock

ST. JOHN, N. B.—St. John has experienced a fairly good industrial year, notwithstanding the labor unrest and other disturbing post-war conditions.

About 500 men have been actively employed throughout the year in dry dock construction and in the development of a shipbuilding, ship repair and harbor plant at Courtenay Bay. A breakwater 7,070 feet long has been almost completed, and good progress has been made on the dry dock scheme. The dry dock will be 1,150 feet long by 125 feet wide, and will be the largest dock of its kind in the world. It is designed to accommodate either one large ship or two smaller vessels. The dock area was inspected by Admiral Jellicoe on his recent visit of inspection to the port of St. John, and he expressed himself greatly pleased with the work that had been done so far. The contract is being carried out by the St. John Dry Dock and Shipbuilding Company, who have sublet the excavation to the Bedford Construction Company. A. R. Dufresne, C.E., is the chief engineer on the work.

The Corona Company are now enlarging their building and chocolate manufacturing plant on Union street. The additions to building and machinery will double the capacity of the plant.

The Atlantic Sugar Refineries have made some extensive additions to their sugar storage plant the past season. It is now one of the best-equipped sugar refineries in Canada and is turning out an excellent product. The refinery is located on the water front and has the advantage of having an all-the-year-round connection by water with the sugar producing islands of the West Indies.

The Crosby Molasses Co., Ltd., recently awarded a contract to Grant & Horne for the construction of concrete bases for two steel molasses tanks. The contract is about completed. The tanks will have an individual capacity of over 250,000 gallons.

The same construction firm is rushing work on an extensive addition to the immigration buildings at West St. John. This work is being carried on jointly by the Immigration Department, Ottawa, and the Canadian Pacific Railway.

The Provincial Lime Company, whose plant was destroyed a few months ago, have lost no time in reconstructing their plant on more comprehensive lines. The factory is now turning out a fine grade of lime, for which a ready market is found.

Max Newfield has recently started the manufacture of hosiery at St. John, and is meeting with good success.

Preparations are being made for an early resumption of machine manufacturing at the plant of T. McAvity & Sons, Marsh Road. During the war this company was among the most active shell manufacturers in Canada. In addition to two units of 400 x 80 ft., they have recently erected a large building as a moulding shop. They will make a specialty of valve manufacturing.

The cotton factories, nail works, brush factories, woodworking and lumber mills have all been very busy during the year. A larger number of men have gone into the woods this winter than for several years, so that there is every indication of a greatly increased lumber cut.

No Labor Troubles in This City

FORT WILLIAM.—Industrially, the past year has been a very prosperous one for Fort William. While there were no sensational demands for local products, all industries were kept fully engaged and activities well balanced.

One of the features worthy of comment, while the present year has witnessed almost universal unrest throughout the Dominion, Fort William industries were not affected. All industrial disputes were amicably adjusted as they arose and the van of production kept moving steadily.

The plant of the Canada Starch Co. has just completed one of the best years of its history, the increasing demand for their product necessitating large additions to the plant during the past year.

The Ogilvie Flour Milling Co. has just completed extensive additions to its plant and have also added a unit for the manufacture of stock foods.

The Canada Car & Foundry Co. have had a very good year, the car department being fully engaged in the building of new freight cars and the repairing of used cars. Their shipbuilding department has been greatly developed, originally designed for the execution of war orders; it will remain as a permanent unit of the plant. The latest product of the plant, the S. S. "E .D. Kingsley," an oil burning freighter, destined for the West Indies trade, is rated one of the most modern freight boats built upon the Great Lakes. Further ship orders have been booked, and the company contemplates the erection of additional shipbuilding facilities at once.

All iron foundries and engineering plants have been running to capacity, and future prospects are of the best.

The Plymouth Cordage Co. are erecting a five-storey, fire-proof warehouse on the harbor front for the storage and distribution of binder twine for the Western trade.

Wholesale and retail business has been very good, the volume being as great as in any pre-war year.

In spite of high building costs the building trades have been quite active, $500,000 being expended in school buildings alone. Additions have been made to several of the grain elevators. A $50,000 skating rink has also been erected. A number of residences were built under the provisions of the Federal Housing Scheme, and several higher class residences were erected. There is still a brisk demand for housing accommodation, and additional homes must be erected next spring.

The relatively high prices obtained for farm produce has given quite an impetus to the business of agriculture and agricultural lands are in good demand. The spring of 1920 will undoubtedly see an influx of settlers to the agricultural lands of this district, which is especially adapted to mixed farming, abounding in wood, good water and fertile soil.

Since the completion of the Scott Highway. connecting Fort William with Duluth and other American cities by automobile route, summer tourist traffic has grown to be quite a feature in the commercial life of the city.

Labor conditions have been remarkably well balanced, there being absolutely no unemployment, and, on the other hand, there has been no curtailment of industrial operations due to labor shortage.

As an indication of the prosperity of the community, it may be mentioned, during the recent Victory Loan Fort William was asked for $1,300.000. Fort William subscribed $2,050,000, thereby showing that this community is not only prosperous, but is willing to share its prosperity with the rest of the Dominion.

Galt Factories Are Growing

GALT.—Industrial expansion to the tune of $119,420 is the record of which Galt can be justly proud.

In January, $2,400 was spent in new buildings, and in the other months the amounts, as stated below, were utilized: Feb., $4,350; Mar., $3,500; April, $25,000; June to November, $30,975. From January to November, $17,195 was spent in additions of various natures.

In addition to the above, Goldie & McCulloch laid out $25,000 in additions. We make this statement separately as this firm is really outside the corporation limits.

The firms below spent the amounts herein mentioned: Riverside Silk Mills, $50,000; The Perfect Machine Tool Co., $20,000; and the R. McDougall Co., $40,000.

Making Tool Steel in Welland

WELLAND.—The only new industry which is established in this city in the past year is the Dillon Crucible Alloys, Limited, which is already doing a very considerable business in making alloy and a high grade steel for tool steel. The company is employing at present sixty hands and the prospects for increased business are exceedingly bright.

There have been no additions to existing factories here, and all of them are progressing favorably.

Hamilton's Big String of 32

HAMILTON.—Hamilton has enjoyed a year of unprecedented success in the securing of new industries and may well look forward with confidence to the future prosperity of the city. Since the beginning of 1919 no fewer than 32 industrial concerns have decided to locate their plants here, and while a few of the smaller ones are already in operation, the larger ones have not yet had time to complete their building operations, so that it will be realized that the city has not yet begun to experience the fruits of a year of marked industrial growth.

For the most part, the new industries are Canadian branches of American concerns which are coming to Canada, not only to care for and develop the Canadian market, but also with a view to looking after their export trade from within the Empire, there being a widespread feeling among the manufacturers of the United States that a high preferential tariff within the Empire is sure to come in the immediate future, and that they will then not be in a position to compete with Canadian manufacturers for the coveted British trade unless they have had the foresight to establish Canadian branches. While many American manufacturers have already made the plunge, there is no doubt but that scores of others are deterred only by unsettled labor and other conditions from doing likewise. This condition applies not only to Canada, but to the entire continent, if not the whole world. It is not at all surprising that the manufacturer should adopt this attitude, more particularly when it is a case of making an investment in what is, to him, a foreign field, but there are indications that he is preparing for quick action when conditions generally become more settled. This optimistic prediction is borne out by the fact that never in the history of the city's industrial department have inquiries from American manufacturers been more numerous than during the year 1919, while the number of inquiries from Britain and other overseas countries also show a considerable increase over preceding years.

While most other places have been in almost constant turmoil during the year, Hamilton, although one of Canada's chief manufacturing centres, and fairly strongly unionized, has had no strikes or labor disturbances of any kind, and this has unquestionably been a big factor in the city's industrial success. There are probably many reasons for this comparative labor rest. Some may ascribe it to the fact that labor is largely represented in the Hamilton City Council, thus giving the workingman confidence in the government of the city. Others say it is due to the fact that in Hamilton a majority of the workingmen own their own homes, and, having a stake in the community, they hesitate to do anything that would militate against the welfare of themselves in particular and the community in general; but in my opinion it is because Hamilton manufacturers have shown the good sense to take their employees into their confidence and evince an interest in their welfare, not only in the shops, but also in their hours of rest and recreation.

Among the larger industries that located in Hamilton during the year, but of which the city is not yet feeling the benefit are: Firestone Tire & Rubber Co., Akron, Ohio; Hoover Suction Sweeper Co., Canton, Ohio; Quaker

City Chemical Co., Philadelphia, Pa.; Gerrard Wire Tire Co., New York; Carr Fastener Co., Cambridge, Mass.; Canadian Carbonate Co., Montreal, Que.; Norton Co., Worcester, Mass.; and Porritts & Spencer, Bury, England. When the plants of these companies are completed they will represent an invested capital running into millions, and will give employment to upwards of 4,000 people, so that unless something unforeseen happens there is no cause to worry about Hamilton's prosperity for some time to come.

Sherbrooke Aiming at 50,000

SHERBROOKE.—Sherbrooke, Quebec, records an increase in the industrial line. The Canadian Connecticut Cotton Mills are duplicating their actual plant and the new addition will cost a million; Julius Kayser are erecting a four-storey plant at an expense of $500,000; Cluett-Peabody (shirts and collars) have purchased a plant formerly owned by a shoe factory and will employ at least 300 hands.

Sherbrooke has inaugurated a great paving plan, which will stand for five years, during which period all our main thoroughfares will be permanently paved; a mile and a half of highway is now paved according to the latest modern methods.

Our Street Railway Co. is building a mile and a half of railway and has doubled its tracking system to a certain extent. A company is established to erect a model city; the capital is $500,000, and the construction will begin next spring, 1920. The future of Sherbrooke is a promising one and with its civic developments, our city should attain a population of 50,000 in a few years.

A gang of seven men that took refuge in a compartment of the hold of the Ward Line S. S. Guantanamo in Brooklyn recently to escape from ammonia fumes coming from a tank, the head of which had blown out, were rescued through the quick wit of another gang engaged on a job of welding. The welders were at work on a barge alongside the same pier when the news of the accident reached them. The seven men were part of a crew of twenty-five engaged on the repair of a condenser. Under too great pressure, an ammonia tank in the engine room gave way, flooding the room in which the men were working. All of the men were able to scramble to safety to the hatchways and upper deck.

Cut off from exit, the seven retreated to a compartment far down in the hold, from which they signalled their location by rapping loudly on the plates with their hammers. Their predicament was grave, as the fumes of ammonia, filtering through the crevices, slowly filled the room and made breathing more and more difficult.

The welders rose to the situation by cutting a hole through the compartment where the men were imprisoned and thrusting down a compressed oxygen pipe line used on their new job. This not only served to blow away the ammonia fumes from the men, but supplied them with comparatively fresh air to breathe for the period of a half hour. Meantime the fire department had been called and Battalion Chief James Heffernan and his chauffeur, Martin J. McNamara, who tied vinegar soaked handkerchiefs over their faces, were lowered into the hold by the welders.

They opened the compartment door and after three trips got all seven men to safety, though the latter were all temporarily blinded from the effects of the fumes and were so weak that they could hardly stand. The heroism of the firemen and the resourcefulness of the welders were the subject of considerable comment in the press.

THEY do tell now that our silver money is getting almost worth more than its face value. That may be so in theory, but when the grocer and the butcher get through with you we can't see wherein the 30-cent standard has been departed from.

THE Ontario Government is advertising for an engineer. Quite a change from the good old days when a man had to be a good Grit or Tory first and some sort of an engineer after that.

THE MARK RUNS RIGHT ALONG BEHIND

The American dollar is still in the lead, and going strong, but the Canadian dollar is second in the race. The pound and the franc are losing more ground. Some financial experts say that the Argentine "lira" and the Spanish "peseta" are really above par, but that doesn't enter very much into Canada's financial calculations.

GENERAL MOTORS GOING INTO BUSINESS IN A VERY LARGE WAY

THE growing importance of the automobile industry in Canada is reflected in the new manufacturing facilities which have become available recently. Many new factories are being rushed to completion, and a number of others are on a production basis.

The plant of Canadian Products Ltd., Division of General Motors Ltd., Canada, is one of the latest to be built for the Canadian automotive trade, and in attention to general design and detail it displays constructive thought of a very high order.

Provision for expansion has been taken care of in the purchase of about ninety acres of plant site, and the layout of the buildings now erected and their location is such as to permit of extension when necessary.

The present buildings are two in number, each 160 feet wide by 600 feet long and one storey in height. Saw-tooth roof construction is employed, steel roof trusses and gypsum roofing being used. The gypsum roof is pored in situ and makes a very light and durable construction, a material saving in steel resulting from its use.

The two buildings are laid out for a total of about 1,100 separate machines, for the driving of which approximately one thousand motors of varying horse-power will be required. Group drive has been eliminated wherever possible. The electrical equipment for the motors is of the remote control type, and direct-connected motors are used with very few exceptions.

Two lines of track serve the buildings, loading docks having been constructed alongside. These docks are of ample width for trucks and will be largely used for the shop transportation system, done by means of electric shop trucks. For the affording of passage between the two buildings across the tracks lift bridges will be installed. These bridges will lift to sufficient height to permit of the shunting cars underneath them.

Large locker rooms are provided in both buildings for employees, and lavatory accommodation is provided in the saw-tooth roofs, access being given by spiral stairs.

Each building is a complete unit by itself with separate entrances and separate time-recording features. Electrically-operated time clocks will be used.

The first building will be devoted entirely to the manufacture of automobile engines, four different types being made, two types of Chevrolet motors, one Buick and one type of Oakland motor. The front portion of this building is given over to executive offices, accounting and other departments connected with the management of the business.

The motors will be manufactured complete from the machining to the final testing on the test floor. In the other plant, front and rear axles will be made, together with automobile transmissions. The machine-tool equipment installed will be of the character demanded by this work and that of the tool-room which is located immediately in the rear of the engineering offices at the front of the building.

The heat-treating plant is located at the rear of this unit and comprises four double annealing furnaces, one forge furnace, and four lead pot furnaces. An electrical heat-treating furnace will also be installed. All temperature control will be done by means of a complete pyrometer system.

The buildings are heated by an isolated power plant which also serves as a substation for the supply of 550-volt power and lighting circuits. Two Wickes vertical water-tube boilers are installed, each of 300 horsepower. They are equipped with Jones stokers, two being provided for each boiler. Forced draft is employed.

A 10-inch overhead steam main delivers the steam for heating to the various offices and the condensate is returned through a 5-inch underground line to the vacuum pump in the power plant. A 6-inch air compressor line is also carried on the same structural framework, supporting the steam line, and compressed air will be supplied by a 12½, 20 by 14 in. Canadian Ingersoll-Rand compressor.

A Cochrane heater forms part of the power plant equipment.

In all about 45,000 square feet of radiation is installed, not including about 1,600 lineal feet of 2-in. header and about 300 feet of 5-in. header. The radiation is installed along the exterior walls and in the saw-teeth of the roof. The Dunham system is used.

Hydro-electric power will be used for plant operation, the transformers being located outside the building and reducing the voltage from 13,200 down to 550. A Canadian General Electric switchboard forms part of the power plant equipment and controls the various plant feeders.

An extensive landscape scheme will be developed and dormitories are now being built for the accommodation of the employees. Later, other accommodation will be developed. A cafeteria is also being erected.

Difficulty has been encountered in the securing of delivery of equipment, and it is estimated that several months will elapse before production will reach 100 per cent. Production on about a 10 per cent. basis is now being carried on in the motor department, and by the end of February it should reach a figure of 75 per cent.

Personnel

Mr. Howard E. Blood is general manager of the Canadian products; Mr. Davidson is chief designing engineer; Mr. Chas. Rich is master mechanic; Mr. Deets is production manager; Mr. Donovan, comptroller; Mr. T. Miller, axle plant superintendent Mr. Cunningham, motor plant superintendent; John Knapp, purchasing agent; A. H. May, works engineer; J. Gold, assistant works engineer; Mr. Bessie, tool engineer, and Mr. Suttle, standards engineer.

AND SHE'S VERY RESERVED, TOO

A young Brantford school-ma'am boarder was a stout, jolly girl and rather broad from rear view. She had kindly consented to look after nine-year-old Jack, while his mother took a month's holidays. Of course, Jack had to be spanked occasionally, and the teacher was quite equal to the task. Jack didn't mind it when he had his "knickers" on, but sometimes the only pants he was allowed to wear was the pair that Nature gave him.

One day she turned him over the knee, and as she applied the shingle, he remarked: "O-o-h gee! Miss Blank, spank easy, it stings awful on the bare, bare place."

"It will do you good," said the teacher, as she paused a moment; "it will make the bare place grow."

"Gee! Miss Blank," said Jack, "you must a-got a lot of spankins when you was small."

And poor Jack couldn't understand why she smacked him harder.

NEW USE FOR AIRPLANE ENGINE

That the airplane engine is not above ordinary humdrum work is shown by the fact that one has recently been installed in a London factory as a stand-by power unit. It burns gas instead of petrol and the cooling water is circulated through a common cast iron radiator. It is an eight-cylinder engine, surplus from the war, and at the aerial rate of living would develop 200 horsepower, but has been rated at 75 horsepower on earth to give it a reasonable length of life.

One of the curious suggestions made in the Southwest for the saving of wheat at harvest is the use of vacuum cleaners of special size and construction. The idea is that machines of the proper construction could be run over the fields and gather up the loose heads of wheat where grasshappers have eaten the stalks. In some cases 50 per cent. of the heads were lying o nthe ground as the result of this insect's activity. Some farmers used close toothed rakes with more or less succes. Others mowed the wheat and raked it up. It is possible the "vacuum" harvester is on the way.

THE MAKING
OF THE
OVERLAND FOUR

The building of automobiles requires special tools and fixtures, in order to obtain maximum production.

BY

J. H. Moore

A YEAR ago, wondering what to do with a plant equipped specially for the turning out of aeroplane motors—now, production already secured, and working upward to an objective of fifty cars per day. One year ago not a source of employment except for a few factory executives—to-day, a payroll of 1,200, with a fifth of them returned men, and the prospects of many more being taken on.

Such, in brief, is the 1919 history of the Willys-Overland plant on the Weston Road, Toronto. The close of the war left this company, in common with many others, with a big problem to look after. Great organizations had been built up to produce munitions, and they had done it successfully. The Weston Road plant had been tuned up to turn out aeroplane engines—the Sunbeam Arab type—and they had done remarkably well in a job that was perhaps, from a mechanical and engineering point of view, one of the most baffling of the war.

The plant as it stands to-day is a tribute to Canadian courage and initiative to Canadian engineering skill, and to the unbounded faith which our captains of industry have in the future of this country and of the countries to which they hope to export.

The other plant concerned in this company, The Machine and Stamping Company, Limited, has a similar inspiring tale. Stamping work in connection with the munition business of the Russell Motor Car Company, together with the manufacture of bicycle chains and spark plugs, formed the majority of their business.

It was only during the early part of this year that they definitely decided to manufacture the transmission portion of this Model 4 car, yet in that short time they have gathered together the best of equipment and help, and have now reached a production basis. Having mentioned the history of the past performance, let us proceed with pres-

FIG. 1—ASSEMBLING THE CHASSIS.

FIG. 2—A PARTIALLY ASSEMBLED CAR.

ent accomplishments, describing the actual operations in the making of the new car.

To bring before our mind's eye a view of the general appearance of the car, let us refer to the illustration, forming a portion of the heading of this article, which illustrates the first Overland Four produced in Canada. It is worthy of note, that seated in the car are four executives of the concern. Mr. T. A. Russell, president and general manager, is at the wheel; Mr. J. G. Perrin, assistant general manager, sits beside him, while Mr. J. F. Mackay, secretary and treasurer, sits at the left hand side of the car, at the rear; and Mr. W. A. Dover, sales manager, is seated at his side.

The Assembling of the Chassis

No doubt everyone is well aware that the first step in the assembly of an automobile is the assembling of the chassis, so let us study closely Fig. 1, in order that we can discuss one of the car's big features.

Here we see the workman riveting together the various members of the chassis, or framework, as some prefer to call it. If you are at all familiar with cars you will note the peculiar shape of these frames, as this form of chassis is only to be found on such type of car.

It is made in this manner to accommodate the three-point cantilever springs which are perhaps the main feature of the entire car. This innovation is claimed to create a riding buoyancy never possible before with a car of like weight. The springs spoken of will show up clearly in a later view. Referring once more to the photo, it will be noticed that these frames are assembled on a special jig, with levers at the side which tighten the framework by means of cam-shaped bodies. The riveting is accomplished with the aid of a gun manufactured by the Thor Tool Company.

Immediately the framework has been assembled it goes through the following sequence of operations:

The springs are now placed in position on framework. The various braces, front axle, bumper brackets, battery pan and front yoke, are also assembled during the next step in the preparing of the complete chassis.

After this has been accomplished, the rear axle is assembled. Next the engine pans are assembled, also the engine itself is placed on the chassis. The starting crank hole is reamed out, and the starting crank shaft assembled in place.

The Painting Department

The partially completed chassis now passes along rails, on a specially constructed carrying truck to the painting department, where the frame is painted black, and the engine grey, by means of an Aeron spray gun.

They now pass through a long drying oven, coming out at the other end baked sufficiently to allow immediate work on the further stages of assembly. This journey through the ovens takes approximately one hour. The complete drying conveyor is driven from a 5-H.P. Westinghouse motor, the speed of the carrier chain being reduced by means of gears connected direct to the motor.

Further Stages of Assembly

After coming out of the drying ovens the various portions of the chassis are thoroughly oiled and greased. Grease cups are placed in position, wheels with tires attached are assembled, and running boards are attached.

A good idea of how the car looks at this stage is seen from Fig. 2. At this point we wish to call attention once more to the three-point cantilever spring and the rear one showing to splendid advantage.

By the use of these springs, one at the front and one at the rear, the spring base is increased 30 inches, and as the chassis has a wheelbase of 100 inches, this makes the spring base 130 inches, which is a feature of design found only in this type of car.

In order to make clear the class of work being accomplished by the two firms concerned in the manufacture of this car it might be mentioned that the Machine and Stamping Company, Limited, manufactures and assem-

A GENERAL BIRD'S-EYE VIEW OF THE WILLYS-OVERLAND PLANT.

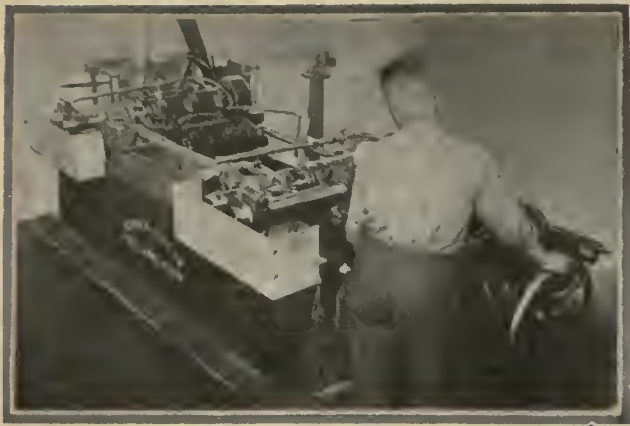


FIG. 3—MILLING BOTH ENDS OF FRONT AXLE AT ONE TIME.

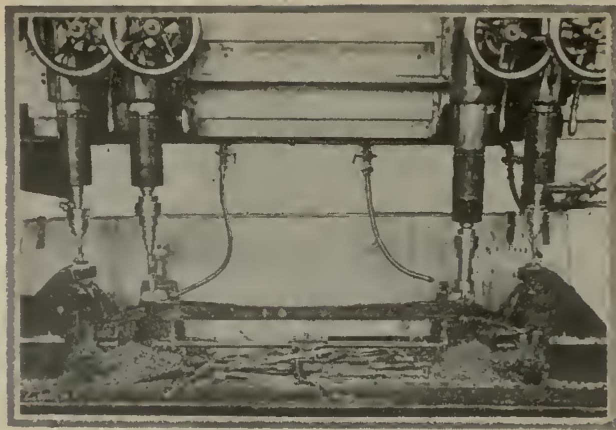


FIG. 4—DRILLING, REAMING AND FACING FRONT AXLE.

bles the transmission, while the Willys-Overland plant make the rest of the power plant—and the remainder of the car, with the exception of about 20 per cent. In other words, at present this is an 80 per cent. made-in-Canada car with 20 per cent. purchased elsewhere. It is, however, the hope of those interested soon to be able to say that it is a 100 per cent. made-in-Canada product. Having pointed out these facts, let us leave the chassis in its partially assembled stage and consider various operations to other portions, individually.

The Front Axle

The front axle is made of I-beam section, drop forged in one piece, and passes through many various interesting operations. Before passing into the machine shop, however, each axle is carefully straightened on a machine for

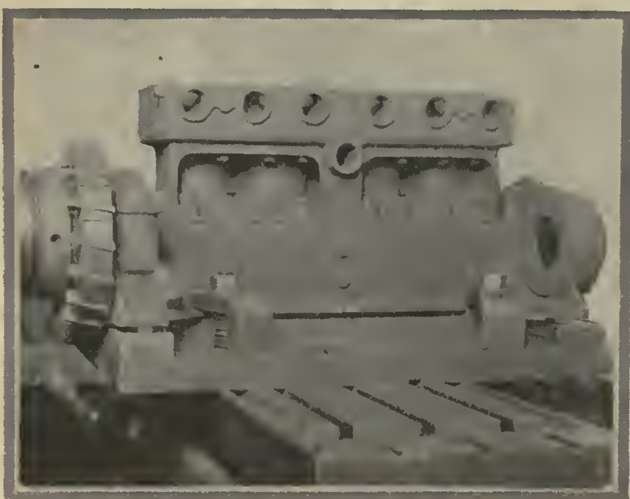


FIG. 5—MILLING THE FLYWHEEL END OF CYLINDER BLOCK.

this purpose. As readers will readily understand it is only possible for us to illustrate a few of the different operations on the various parts, so we will show only two of the steps in the manufacture of the axle.

The first of these operations (see Fig. 3) illustrates a very interesting fixture on an Espen-Lucas horizontal miller. Here we see both ends of the front axle being machined at the same time by means of eight cutters. A machine of this nature equipped as shown means steady production, which is so essential where a certain daily output is absolutely necessary.

The operation shown at Fig. 4 is that of drilling and facing the different holes in the front axle. This operation is performed on a Foote-Burt four-spindle drill. By careful study of this picture the design of the jig can be clearly noted. The axles are gauged from vee blocks, which come in from each end, at a uniform speed, operated from a handle at the end of the jig, but which is not shown on the photograph.

After all operations on the front axle have been performed, they are forwarded to the front axle assembling department, where on special stands made for the purpose the workmen assemble steering knuckles and various other parts to the axle.

The Cylinders

To describe, operation by operation, the work on the cylinder blocks would prove too intricate, and take up too much space to suit the purpose of such an article as this, so again we will consider only certain interesting operations.

At Fig. 5 we illustrate the operation of milling the flywheel end of the block on a Kempsmith Miller. These blocks are placed on a special jig plate and are then clamped in position as shown. Of course, they are gauged from a positive point, as one can readily understand. Other milling operations of like nature are performed on millers of both the vertical and horizontal type. In every case the block is gauged from the same gauge point, so that no error can result and the work is interchangeable, which is a very necessary point to be considered.

FIG. 6—A SPECIAL EIGHT-SPINDLE CYLINDER BORING MACHINE AT WORK.

Another very interesting operation is that of boring and reaming the four cylinders. This work is accomplished on a special eight-spindle machine made for the purpose by the Defiance Machine Co., and is illustrated in Fig. 6.

This is the only machine of its kind in Canada and is well worth considering in detail. The four spindles to the left of the picture perform the function of rough boring the cylinders, while the four at the right of photo ream out the rough bored surfaces. The main machine of the table revolves, 90 degrees at a time. The reason for this is apparent, viz., that while the machine is rough boring and reaming two cylinder blocks the operator is unloading and loading at the other two stations on the table. It is in installations of this kind that we see the benefit of special machines for special purposes.

Another single purpose machine is illustrated at Fig. 7 and 8. Here we show a Baush three-way horizontal drill

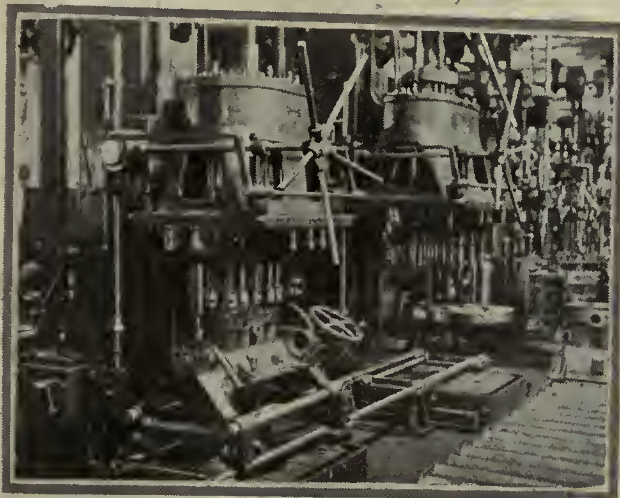


FIG. 9—TAPPING BOTH TOP AND BOTTOM OF CYLINDER BLOCKS. 38 HOLES ARE TAPPED AT THIS OPERATION.

at work on the cylinder block. Forty-seven holes are drilled at one time in this machine. The view, Fig. 7, depicts the back view of the drills about to enter their bushes, while Fig. 8 illustrates the front view of machine showing the drills coming in from either side.

The cylinder block itself is mounted on a jig block which slides out and in on the portion marked A on photograph. It is hardly necessary to state that production, coupled with interchangeability, is a big point in this machine's favor.

Another Interesting Installation

Our next view at Fig. 9 is still another argument in favor of special equipment. In this case we have two

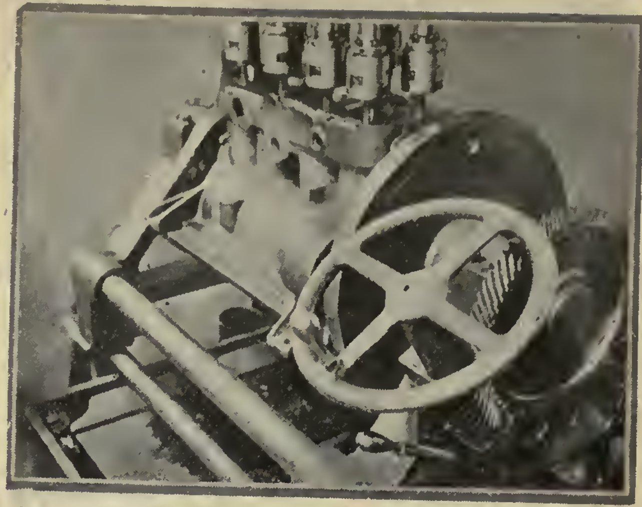


FIG. 10—THE REVOLVING JIG USED IN CONJUNCTION WITH THE MACHINE SHOWN AT FIG. 9.

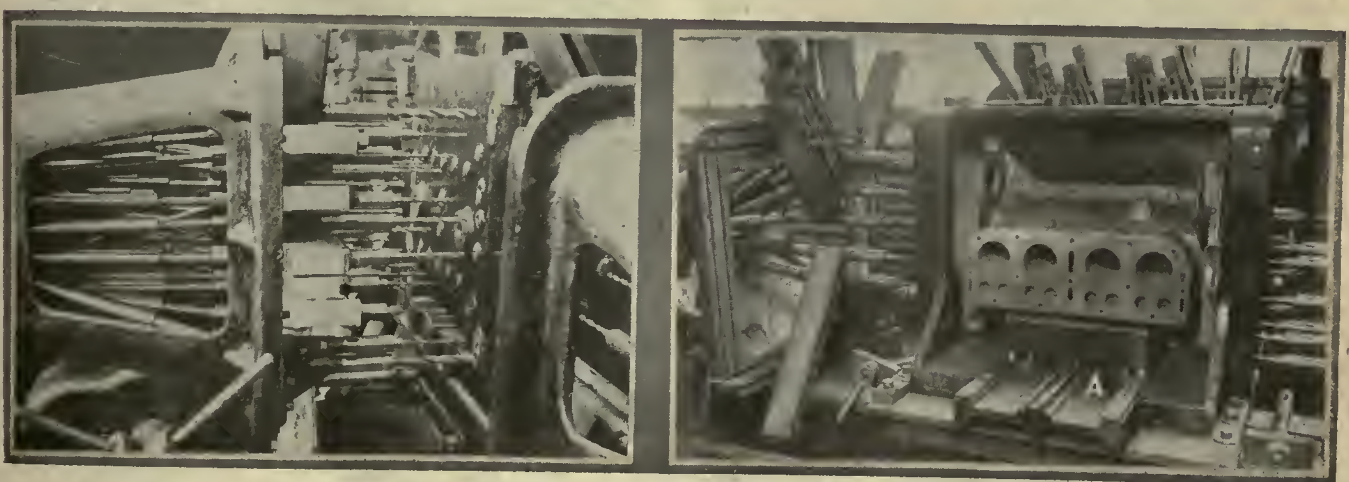
Natco drills, used for tapping in this particular operation, arranged side by side and connected up by means of a set of rails.

At this operation the block is tapped both top and bottom, twenty-four holes in one case and 14 holes in the other. In conjunction with these drills, there is a special revolving jig which we illustrate by itself at Fig. 10. The action of these two operations is self-apparent. One set of holes are first tapped, then the carriage with four grooved wheels, which forms a part of the jig, is pushed along the rails between the two machines. The jig is now revolved 180 degrees by means of the hand-wheel A, shown at Fig. 10. This controls an indexing attachment operated through a worm and worm wheel, that can be clearly noticed on the photograph. The other details are so self-apparent that no further comment on these photographs is necessary.

As stated before, there are other innumerable operations on the cylinder block which we cannot enter into, but at least we have shown some interesting steps in its progress to completion, so, taking it for granted that all the remaining machining parts have been accomplished on this portion, let us consider other parts of the car.

Other Engine Parts

Other operations on various portions of the engine will next be considered. At Fig. 11 is shown the operation known as finish grinding line bearing on the crankshaft. This work is accomplished on a Norton grinding machine, as are other different operations of similar nature. There are quite a few grinding operations on the crankshaft, but the photograph illustrates the average style of accom-



FIGS. 7 AND 8—TWO VIEWS SHOWING THE DRILLING OF CYLINDER BLOCK OF SPECIAL BAUSH THREE-WAY DRILL.

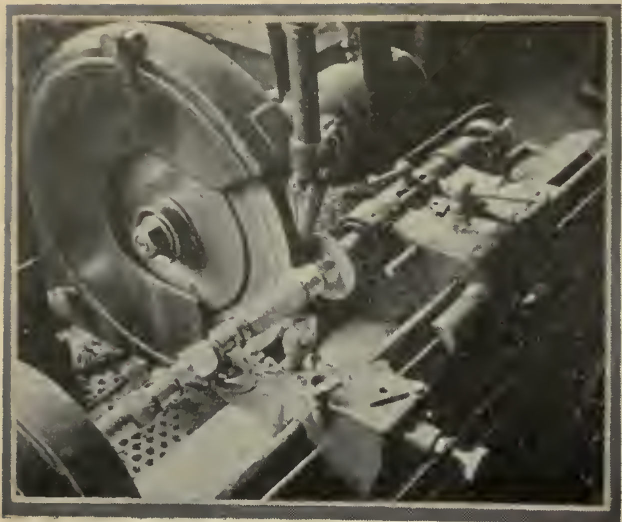


FIG. 11—FINISH GRINDING LINE BEARING ON THE CRANKSHAFT.

plishing such work. The photo, being a close-up view, allows one to see clearly the various details.

We notice at Fig. 12 another case of special equipment used to advantage. This view depicts a Becker double spindle vertical miller, arranged with a revolving, continuous milling fixture. This fixture is designed to take care of 18 connecting rods, the spindles being equipped with cutters of proper design to mill both ends of the rod at once. As stated previously, the fixture is continuous in its action, the operator loading and unloading at the various stations while the machine keeps on producing. Attention is called to the rack to the extreme right of photograph. This is simply a double-sided stand on four wheels with wooden pins on which the operator places the finished rods, that is, finished as far as his operation is concerned.

It is small details, such as this method of handling the rods after each operation, that help to speed up the work throughout the plant.

Of course, this step is merely a start of the many other stages in the connecting rods' journey; for they must be drilled, reamed, tapped, etc., etc., before arriving at the finished stage. Lack of space prevents us entering into greater detail, but suffice it to say that in every case special jigs and fixtures form a part of each operation.

At Fig. 13 is shown a Foote-Burt four-spindle drill at work on the exhaust manifold, the operation in this case being drilling and facing the four holes shown. This photo shows up the details so clearly that we feel no comment is necessary.

FIG. 12—MILLING 18 CONNECTING RODS ON A CONTINUOUS MILLING FIXTURE.

FIG. 13—DRILLING AND FACING FOUR HOLES IN THE EXHAUST MANIFOLD.

Work on the Transmission

We often hear the saying that a change is as good as a rest, so suppose we now consider for a short time the work being performed on the transmission parts at the Machine and Stamping Company, Limited.

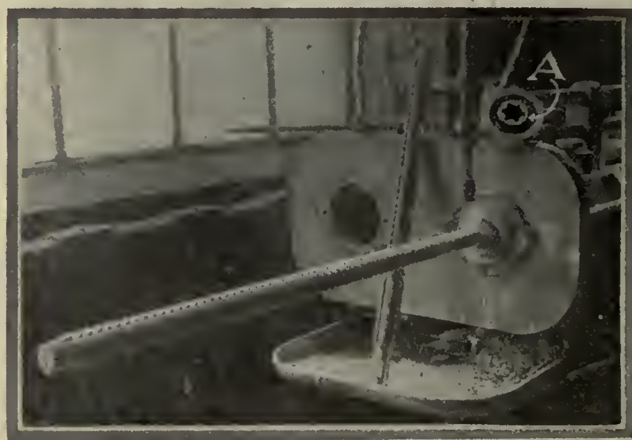


FIG. 15—BROACHING SIX KEYWAYS ON TRANSMISSION GEARS.

Again we must confess that it is impossible to enter into as deep detail as we would like, for one could prepare a regular volume on the making of a car of this nature, but before commenting on any further photographs, we will discuss two operations which are not here illustrated.

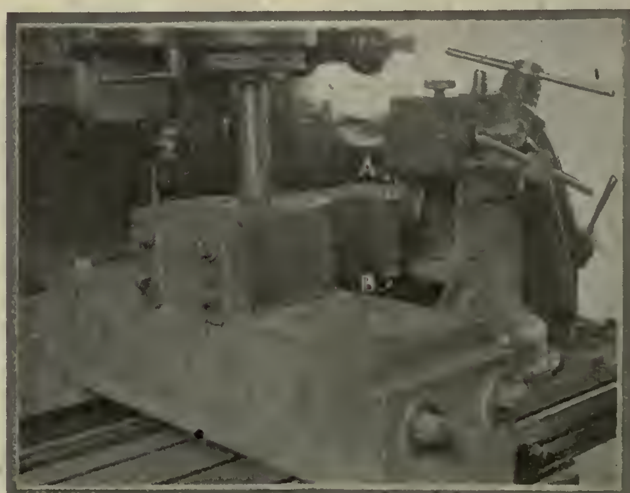


FIG. 14—MILLING INTERNAL BOSSES ON THE TRANSMISSION CASE.

The first of these is the lathe work performed on the case itself. These operations are done on Potter and Johnson automatic lathes, the work being held in special chucks. Another operation of interest is that of milling the pedal shaft boxes on a Garvin duplex miller. Two cutters perform this work, one on each side of the gear case, the result being a quick, accurate job, with all parts interchangeable.

Referring now to Fig. 14, we see a very clever fixture on a Brown & Sharpe vertical miller, designed to mill two bosses inside the transmission case.

This internal milling fixture is driven direct from the main spindle of the machine, being fastened in the manner shown. The two cutters, A and B, accomplish the facing of the internal bosses, the case being fed up into the fixture.

Broaching six splines, or keyways, on the transmission gears forms the subject of Fig. 15. This work is done on a Lapointe broaching machine and in the photograph shown the broach is just about to enter the work. To further illustrate the type of broach used we have set one at the side of the other where its general proportions can readily be ascertained. The work itself is shown separately on top at A. A good stream of special lubricant is playing on these gears at all times, as the steel is of very high order.

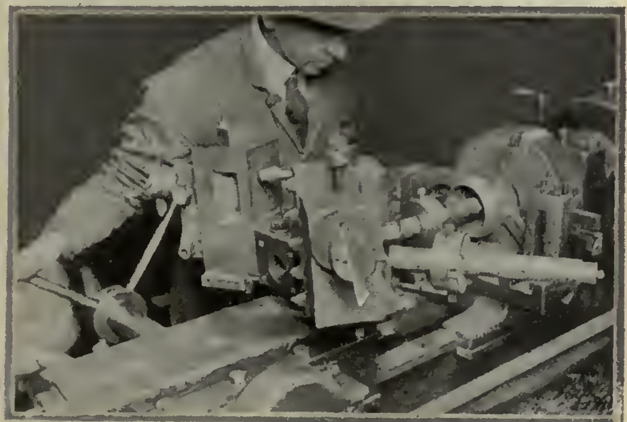


FIG. 16—ROUGHING AND FINISHING UNIVERSAL BALL JOINT.

At Fig. 16 we illustrate the roughing and facing operation of the universal ball joint, the work being performed on a Warner & Swasey turret lathe. This work is accomplished in one operation, and the tooling is shown quite clearly.

Last, but important as any other operation in this plant, we show at Fig. 17 the machining of the universal ball joint socket.

First this piece is bored, then the radius is rough turned, after which it is finished by means of a specially constructed tool and guide. It is this tool that is in operation in the photograph.

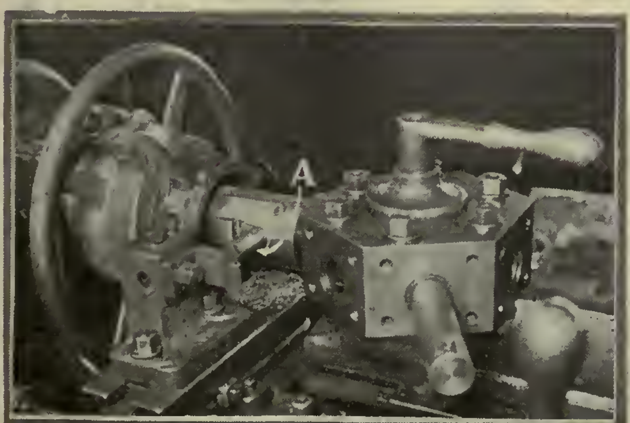


FIG. 17.—MACHINING THE UNIVERSAL BALL JOINT SOCKET.

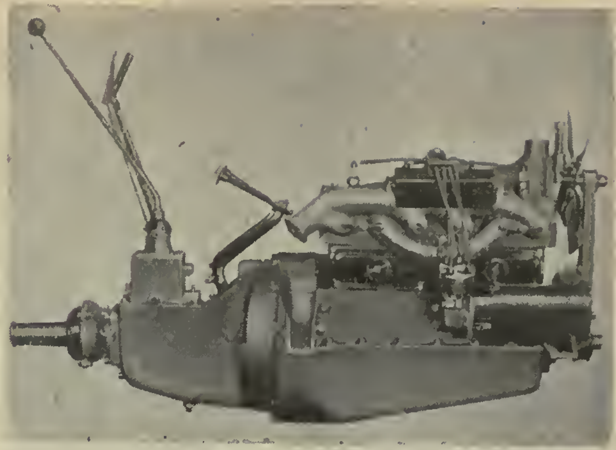


FIG. 18—THE POWER PLANT AS IT LOOKS FROM THE DISTRIBUTOR SIDE.

Briefly its action is as follows: The portion A presses against the guide B. The cross slide operates this guide at the proper speed, which in turn pushes the plunger A in at a predetermined rate. On this plunger are cut a number of teeth which mesh with a quadrant, C, a portion of the teeth being clearly noticed in the photograph. To this quadrant is attached the radius turning tool.

The action is now easily followed out. The plunger moving in rocks the quadrant, which moves the turning tool at the correct radius.

The saddle in the meantime has been feeding in at proper speed, which combination of movements accomplishes the operation.

Before leaving the subject of this plant, it might not be amiss to mention the splendid tool equipment they possess, the well-laid-out tool room and inspection department, in fact, all the vital points which go to make up a successful organization.

We will perhaps, at a later date, go further into the details of the inspection system adopted by this company, enough to say for the present that no jig is allowed to be used in the factory without undergoing a thorough test in this inspection department. We will leave the transmission case at this point, taking it for granted that it has passed through its various stages and finally been assembled and shipped out to the plant of the Willys-Overland, there in turn to be assembled to make up the complete power plant of the car. At this point a glance at Fig. 18 would be a good idea, as we then can figure about how the power plant would appear from the distributor side.

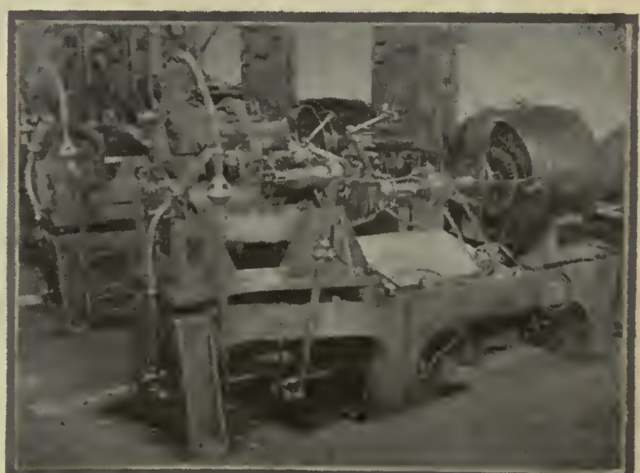


FIG. 19—A VIEW SHOWING THE BLOCK TEST STAND, WITH ENGINE IN POSITION.

FIG. 21—TURNING FOUR INNER BRAKE BANDS AT A TIME ON A PRENTICE LATHE.

Now that we have arrived back at the plant, let us follow the engine from this point on.

Testing of Engines

After assembly all engines are carefully block tested. To get some idea of these block test stands we illustrate an engine during test at Fig. 19. At the side of each testing stand is a huge switchboard on which is installed all necessary equipment to show just how the engine is performing. The engine is first set in motion by the motor shown to the right of the picture, then the carburetor is properly adjusted until the engine is firing properly, after which the motor switch is shut off. The engine now runs on its own power. The revolutions per minute, mileage, battery, etc., all show clearly on the switchboard.

The main switch is next placed on load position and the control button pressed. The engine is now running on what is known as grid resistance. The load is of course varied to test the engine thoroughly and a record made of its performance.

Should any defect occur, it is taken to a special revolving dis-assembly stand, where the trouble is remedied. This stand is revolved in such a way that the operator is always working in a comfortable position, irrespective of the location of the trouble in the engine.

After leaving the testing department and having been certified as O.K., it is ready for assembly to the chassis.

FIG. 20—CUTTING EIGHT CAM GEARS AT ONE TIME ON A GOULD & EBERHARDT GEAR SHAPER.

Other Interesting Operations

We will now consider a few more miscellaneous operations on the car, after which we will proceed with its further stages of manufacture.

Fig. 20 illustrates the cutting of the cam gear on a Gould and Eberhardt gear cutter. Eight blanks are mounted on the spindle at one time as shown, the hob or cutter going right down the line. It is hardly necessary to comment further on this photograph as the details are so clear.

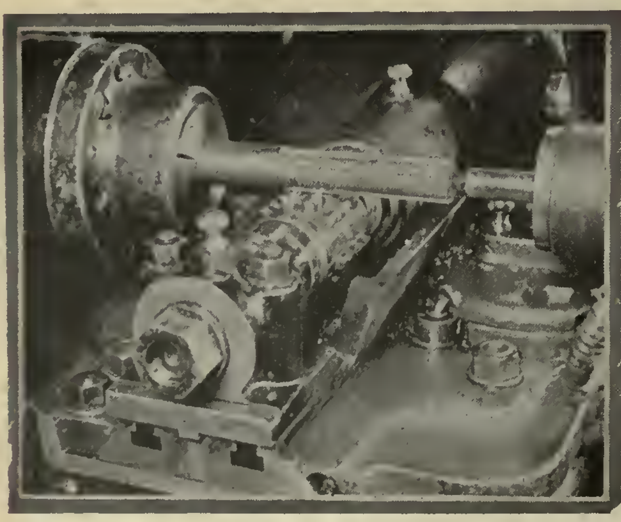


FIG. 22—HOBBING THE SPLINE END OF PROPELLOR SHAFT.

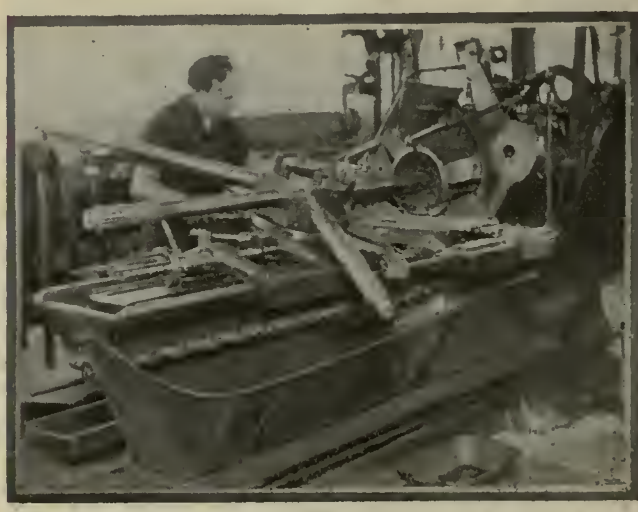


FIG. 23—BORING AND FACING REAR AXLE HOUSING.

Turning four inner brake bands on a Prentice lathe is illustrated at Fig. 21. By means of a special quadruple tool holder, this work is very easily accomplished. The work itself is held on a mandrel made specially for the purpose. Here is a case where by a little ingenuity production was increased to a considerable extent and well repaid the cost of special tooling.

Another hobbing job of a different nature is shown at Fig. 22. This operation is known as hobbing the spline end of propeller shaft, and is accomplished on a Barber & Coleman gear cutter.

The next photograph, Fig. 23, illustrates the boring and facing operations on the rear axle housing, the work being performed on a Gisholt turret lathe. As this style of work is somewhat along the usual line of machine shop practice we leave the reader to study the photograph at his leisure.

The Layout of Operations

It might he interesting to call attention to the system of arranging the various operations. At one portion of the main floor is arranged the different work on the cylinder block and cylinder head. Mathew gravity conveyors run between the various machines engaged on this work, which naturally speeds up the handling of the product. For other methods of handling, various style trucks are used, including the well-known line of Cowan Transveyors.

At another portion on this floor the various operations on the flywheels are performed, Mathew gravity conveyors again being used at the sides of machines to aid in the handling of the work.

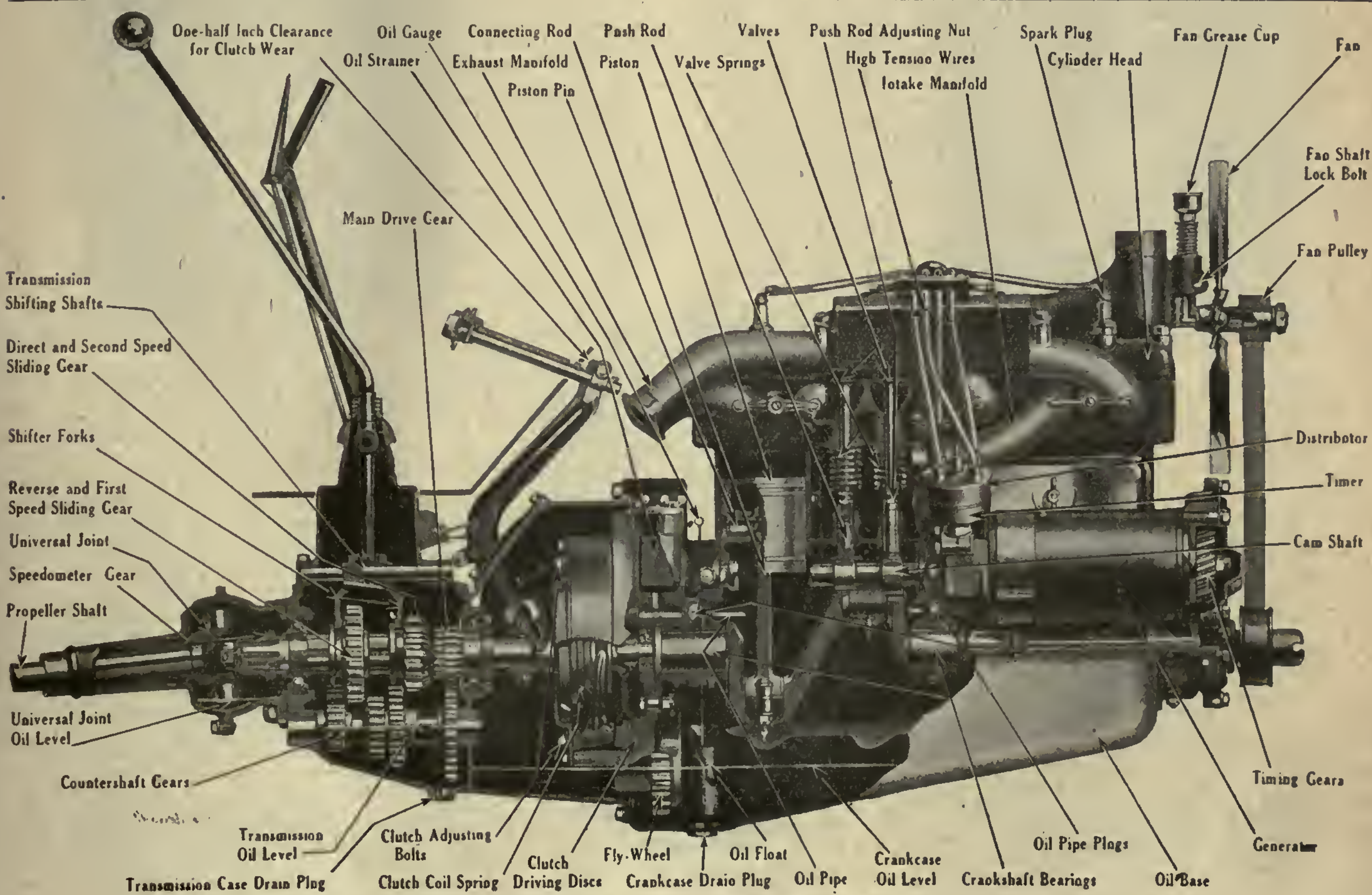
Across from this department on the same floor the various operations, on propeller shaft, back axles, crank shafts, cam shafts, etc., etc., are accomplished. On the same floor level, but in another department, the assembling and testing of engines takes place, the various storerooms for these different parts being placed in the very best position for easy access.

FIG. 24—A SECTION OF TOOL ROOM, SHOWING INSTALLATION OF SMALL LATHES AND MILLER.

The front axle assembly and rear axle assembly are in a different department, but also on the same floor level.

The Heat Treating Department

The heat treating department is also located on this main floor, and more than passing mention should be made regarding this most important portion of the organization. This department is well equipped with American



A SECTION SHOWING CROSS-SECTION OF ENGINE, CLUTCH, TRANSMISSION, AND UNIVERSAL JOINT.

TECHNICAL DESCRIPTION OF THE CAR

For readers familiar with mechanical details we publish this brief description. Our object in thus separating the mechanical data, is in order to allow the general reader to continue the main article without entering into confusing details.

There is one radical departure from general engineering practice which dominates the new Overland. This is the method of spring suspension. Mounted on a wheelbase of 100 inches, the springs are so arranged that the distance between the spring supports is 130 inches. This suspension, which is virtually a cantilever system, projects ahead of the front axle and behind the rear axle, giving an overhang of 15 inches beyond the axles at each end.

This combination of short wheelbase and overhanging springs has enabled the production of a car which weighs less than 2,000 lbs., while giving maximum room for occupants.

Simplicity is an outstanding feature of the chassis. A unit power plant, a propeller shaft enclosed in a torque tube, and a three-quarter floating rear axle enclosed in a two-part malleable iron housing complete the driving parts. The frame has parallel side members with very heavily reinforced end pieces to take care of the strains and stresses imposed by the spring suspension. There are no cross-pieces between the rear end of the frame and the engine support, consequently the result is a flexible structure rather than a rigid one. In fact, the chassis suspension is practically a three-point arrangement. There is but one shackle on the entire car, at the left rear spring. All other points of spring suspension are fixed.

The engine is of L-head type with detachable cylinder head. Cylinders and crankcase are cast integrally. Crankshaft bearings are die-case babbitt, and are reamed to size during the manufacturing process. The bearing caps are shimmed for adjustment.

The flywheel is a semi-steel casting, machined all over and marked for ignition timing. It is drilled for balance after assembly to the crankshaft. The flywheel teeth act as oil carriers for the lubricating system, as well as for the engagement of the starting motor.

Helical timing gears drive the camshaft and generator. The gears are located at the front of the crankcase in a separate housing.

The camshaft is drop-forged with integral cams. It is mounted on three bearings. The front bearing is die-cast, and the other two are out of bronze. The valves are operated through mushroom tappets and cast iron guides which are integral with the crankcase.

Means have been taken to insure the flow of an ample supply of water through the thermo-siphon system. The jackets are large, and the radiator is of cellular type with non-corrosive sheet brass tubes made of an alloy of copper and zinc. The radiator shell is a pressed steel one-piece unit, and a fan shroud on the back of the radiator further assists cooling. The fan is a four-blade, steel stamping, belt driven with an adjustment provided through the fan lock-shaft bolt. The fan-belt is located in front of the fan, thus permitting the bolt to clear the timing gear case readily and the fan to be in approximately the same plane as the timing gear case, reducing the overall length of the engine to a minimum.

Constant circulation of the oil is maintained by the flywheel gear teeth. The oil is taken up to a reservoir and is thrown into a strainer where it is filtered. It is then led to the main feed pipe which runs the full length of the cylinder block and which is connected with the crankshaft bearings through three openings. Scoops on the lower ends of the connecting rods splash the oil to the cylinder walls and to the other bearings. The timing gears are lubricated through a small hole in the end of the main oil feed above the front main bearing. The oil in the crankcase communicates with the clutch, gearset, universal point, speedometer gear, lighting generator and starting motor drive end bearing There is a float oil level indicator on the left side of the engine.

The gasoline tank is located under the cowl, providing a gravity feed for the fuel. The material used for the tank is terne plate (lead coated steel). The carburetor is a Tillotson of special design, equipped with hot air attachment.

The carburetor is on the opposite side from the intake manifold, the gases being drawn through the cylinder blocks. The inlet manifold as well as the exhaust is cast separately and is attached to the cylinder block by three clamps.

Auto-Lite electrical equipment furnishes ignition, starting and lighting, the generator being of four-pole type with third brush regulation. It is mounted on the left front side of the engine. The storage battery is 11-plate, 3-cell, 6-volt type rated at 80 ampere-hours. It is located beneath the driver's seat. No battery cover is needed, as the wooden seat lid affords both protection and ventilation.

The circuit-breaker is of Auto-Lite rectangular type with the cut-out speed of 6 m.p.h. This is 1½ m.p.h. less than the cut-in speed, thereby avoiding frequent cutting-in and cutting-out when travelling at very low engine-speed. The regulator is mounted on the right gasoline tank bracket. A current indicator, reading charge and discharge, is mounted on the instrument board.

The clutch is a single plate unit of semi-steel mounted on a splendid clutch shaft and clamped between the flywheel and another iron ring by means of a spiral spring. Between the flywheel, clutch plate and thrust ring are interposed two moulded asbestos plates. Pressure is applied to the spring for engagement through three toggle levers by a 300-lb. spiral spring. The entire clutch assembly operates in oil, and is constructed in unit with the engine and gearset, thus giving a completely enclosed part.

The gearset is of practically standard construction. Gears are of the stub-teeth type, and the main shaft is supported at the front end by a phosphor bronze bearing and in the rear by an annular ball bearing. The countershaft is carried in two phosphor bronze bearings, and the reverse idler operates on a bearing of similar material. The gears are nickel steel, the countershaft gears being all made in one forging.

Because of the use of a torsion tube, but one universal is needed on the propeller shaft. This is of double-yoked and double ring type, and is drop-forged with the four pins running in oil and enclosed in a ball and socket joint of malleable iron.

The propeller shaft is of nickel steel, and is supported at the front end on a phosphor bronze bearing and at the rear on a double row of ball bearings, taking both radial and thrust loads.

The torsion tube is carbon steel of round tapered seamless tubing. The front end slides in a ball joint, and the rear end is forced into place by hydraulic pressure and riveted to the propeller shaft bearing carrier.

The three-quarter floating rear axle is carried in a two-part iron housing, carrying the differential, two steel axle tubes and two malleable iron brake supports pressed and riveted together. The differential is a four-bevel pinion type, located concentrically with 12 teeth in the pinion and 24 in the gear. The differential is carried on two annular ball bearings, each capable of taking end as well as radial thrust. The drive pinion and gear are nickel steel and are spirally cut. The pinion contains 10 teeth and the ring gear 45 teeth, giving a reduction of 4.5 to 1.

Pressed steel channel section side bars are used in the frame construction. The springs are secured to the frame at the front end by bolts, and to the front axle, close to the wheels, by eye bolts. The radius leaves act as guides for the front axle. The rear left spring is bolted to the frame and shackled to the brake support on the rear axle, and the rear right spring is bolted to the frame and secured to the brake support on the rear axle with an eye bolt, thus providing the solitary spring shackle construction which is a feature of the suspension system. All elongation of spring centres is taken care of by this single shackle. The car is driven through the springs, the reason given for this being that the stresses on the axle are taken directly at the wheel instead of at the centre, thus permitting the use of a lighter axle and less unsprung weight.

The shipping weight of the car is 1,825 lbs., and the weight complete with gasoline, oil, water, tools and side carrier with extra rim is 1,940 lbs.

Four of the Executives Behind the "Four"

T. A. RUSSELL, president and general manager of Willys-Overland Limited, has been in the automobile business for some time in Canada. Not only is he now president of the Willys-Overland Limited, but also of Russell Motor Car Co., Machine & Stamping Co., and Canada Cycle & Motor Co., and when the word president is used, take it as a fact that there is no reference to the easy-chair, carpet-slipper variety.

Besides his many industrial activities and presiding over the destinies of Toronto National Exhibition as president, Mr. Russell's bent is toward farming and stock raising. He goes in for the real thing in stock, and his farm "Downsview" is the home of stock good enough to bring back the first prize from Chicago International last year and second place at the same event this year.

Tractor plowing has also held Mr. Russell's sympathy and interest for some time—so much so in fact that it would have occasioned no surprise had he turned to the making of tractors when war contracts were over.

Just recently he completed a tour of the West, sizing up the situation from the standpoint of disposing of the product of the Toronto plant. He returned and hung out the sign, "Full speed ahead," and that is just what has been happening ever since.

MR. T. A. RUSSELL

MR. J. F. MACKAY

J. F. MACKAY, as business manager of the Toronto "Globe," gave up one of the highest positions in Canadian newspaper work to become associated with the Russell Motor, and later with Willys-Overland Limited, as secretary-treasurer. Whether such a position as "general negotiator" exists in connection with the plant, we do not know, but if such a department were to come into existence, Mr. Mackay would be elected on the first ballot. If there is anyone in the office who has come closer to the men in the shop in a shorter time, we'd like to hear of him.

Speaking of the automobile industry in Canada, and more particularly of the outlook for disposing of the output of the Willys-Overland plant, Mr. Mackay was particularly enthusiastic. The labor troubles at the plant he regarded simply as part of the transition from war to peace lines, and were, he hoped, a thing of the past now. The Canadian market for the Overland Four is very large, and the big problem is not in selling the product of the factory, but in getting the product turned out in large enough quantities.

FRED G. ADAMS, factory superintendent, moved over to the Willys-Overland plant when the war contracts were wound up at the Russell Motor plant. Just now the neat little task facing him is the raising of the production capacity of the plant to fifty cars a day.

Like Mr. Perrin, Mr. Adams came into the automobile business via the bicycle route, in which he had a thorough training. In fact Mr. Adams has had a training covering a broad field, secured largely by individual effort, study, and many worth-while opportunities to observe the best things in machine shop practice and production methods.

MR. F. G. ADAMS

Mr. Adams believes in the Overland Four—he must, because he drives one—a neat Sedan type. He drew attention particularly to the manner in which material is routed in the plant, to the inspection of everything entering the car before and after assembly, and to the efforts that were being made to eliminate "chance."

Mr. Adams had much to do with carrying out the large shell contracts of the Russell Motor Car Co. The appreciation of the munition workers of Mr. Adams' assistance and fairness there was shown in a most tangible way, when they were leaving at the expiration of the contracts. On that occasion he was given a handsome grandfather's clock. It's a fair compliment to be "presented" when you are not leaving, but left, as was the case then with Mr. Adams.

J. G. PERRIN, assistant manager of Willys-Overland Limited, is an automobile man through and through. He knows cars and knows them thoroughly. He has designed cars of the racer type that have successfully contested some of the classics of the auto racing world. The U.S. Government was quick to recognize his worth during the war, when he was summoned to Washington as a member of the Aircraft Production Department. It was in this way that he came in touch with the aircraft division of Willys-Overland Limited. Shortly after this, at the suggestion of the Willys-Overland Company, and with permission of the U.S. Government, Mr. Perrin took charge of the making of aircraft motors at the Toronto plant. Before the conclusion of the war the company was turning out five Sunbeam-Arab airplane engines in an eight-hour working day.

MR. J. G. PERRIN

The Overland Four is largely a car designed on lines worked out by Mr. Perrin. "There is no doubt," said Mr. Perrin, "about the new model being absolutely certain. The car was thoroughly tested for two years before we adopted the final design, and we are making that car now."

gas furnaces and Rockwell furnaces of various types. It is here that the cam shafts, etc., are decarbonized. Each shaft is placed in separate tube, heated to 1,650 degrees F., then left overnight to cool.

The valve tappets are hardened by the lead bath process, in a special holder, which accommodates five at a time. In this same department is a blacksmith shop for general work of such nature required throughout the plant. A very interesting installation in this portion of the plant is a Beighler pyrometer, controlling, if necessary, twenty furnaces. By this means one can tell at a glance if the different furnaces are up to their proper heat.

Work Accomplished on Various Floors

Pistons, connecting rods, front axles, rear axle housings, brake supports, exhaust manifold, inlet manifolds, water elbows, inner brake bands, and other portions are made on the second floor, while on the third floor between one hundred and fifty to one hundred and seventy-five different parts are made. Each part is followed through in proper sequence, thus eliminating all unnecessary motion.

On the fourth and top floor of the building is situated the tool room where all jigs, fixtures, etc., are made. This is a department well equipped in every respect, even to the smaller machines shown at Fig. 24. These small lathes and miller shown at the right of picture are Pratt and Whitney products and are used on very small pins, etc., which are often necessary for jig and fixture work.

Further Progress of the Car

Having commented on the routine of operations, let us continue to study the partially completed chassis where we left it, and follow it through to its completion. To refresh our memory suppose we once more glance at Fig. 2. We note that up to this stage no radiator has been placed on the car. The placing of this radiator is the next step, after which the car is placed on rails, shown to the right of Fig. 2, and passes gradually along, parts being added as it proceeds.

Fenders, etc., are placed in position, and bodies are lowered through a hole in upper floor onto the chassis. From this stage the progress is very rapid. All connections are tightened up, bolts screwed into position, electrical connections made and other various details too numerous to mention.

On reaching this final stage they appear as shown in Fig. 25.

The car now being completed, the gasoline tank is filled and ready for the road test. In a moment of enthusiasm the writer suggested that he actually go with the driver on this road testing tour, and he did—but—well, at least, he can write from personal experience.

The Road Test

We went eleven miles altogether, and over such roads as, bad as our Canadian roads are, never, in my mind at least, existed before.

In some cases we went into holes and ruts that while they have so far not reached China, have not far to go. Bump, bump, bump, we went on. At last I ventured a remark to my driver, who seemed glued to his seat, so engrossed was he in his task, "Won't you break the car at this rate of going?" I enquired. "Nope," was the reply—"they all get the same treatment." I mentally figured out how this driver's inner works were holding out under these daily tests. One point I noticed, was that in spite of the extreme rough going, the riding was not nearly so unpleasant as might have been expected. Had it not been that my driver seemed to grumble if he did not hit at least 90 per cent. of all the holes and ruts on the road, I might have enjoyed my ride. "See this hill ahead," spoke up the driver. I nodded, and he continued: "Starting at the bottom at 5 miles per hour, we must finish at a speed of 25." Personally, I had my doubts if we would do it, but I felt—that, well—time would tell, so sat tight and waited for the hill, which was really a hill and not a mere mound. We slowed down to 5 miles per hour, then up we went, gaining speed evenly and steadily until

FIG. 25—THIS ILLUSTRATION WILL GIVE READERS A GOOD IDEA OF HOW THE CARS COME DOWN THE ASSEMBLING RAILS.

actually 28 miles per hour registered on the dial when we reached the crest of the hill.

Soon we returned to the plant, none the worse for our drive, and with my mind thoroughly made up that one position I would leave strictly alone was the testing out of these cars. Never has it been my privilege to witness such a thorough test.

During these tests, should any trouble develop, the car is taken back to the factory and the trouble remedied. As a general rule, however, this condition seldom happens. A final road test is always given by the chief road inspector after the preliminary tests have been gone through. Until such time as he places his O.K. on the car, it is not considered as a completed article.

After completion it is shipped in the usual manner, this department being also well equipped with side tracks and other shipping facilities.

As a conclusion to this article we might add that the making of an automobile is a bigger proposition than many imagine. The machine tool equipment must be of the very best, the mechanics employed must be of high standard, and, to obtain uninterrupted production, considerable planning and arranging of operations must be accomplished.

This task requires executives who thoroughly understand the requirements of such a plant, and we feel safe in saying that it is the lucky choice of these various heads which has accounted for such remarkable progress.

CANADIAN MACHINERY asked these gentlemen to state briefly their viewpoint on their pet subject and they have kindly done so.

On one page of this article portraits of these men, with their statements appear, and we cannot do better than say "read and digest," for what they remark is right to the point.

At some future time we hope to show other operations on this car for the perusal of our readers.

Broaching as an Aid to Greater Production

The Third and Last of a Series on the Above-Mentioned Subject. Interesting Examples of Set-Ups Are Given, Which Should be Especially Valuable to Tool Designers

By FRANK H. MAYOH

IN making up this final section on broaching practise mostly examples of set-ups will be shown, and it is in this branch of the subject that a tool designer may display his ingenuity; here he may decide how many parts can be successfully handled at one time, the type of fixture needed, means of locating, and other such points as it is customary for a tool designer to determine. This distinction is made between broaches and fixtures for holding the work, because in designing broaches the designer must be largely governed by what practical shop experience has proved commercially practical, while fixtures, being a combination of new elements for each job, dependence need not be so completely based on what has gone before.

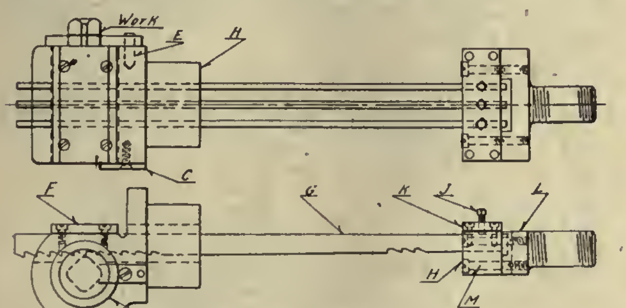


FIG. 30—METHOD OF BROACHING THREE SLOTS IN A STUD.

An example of external broaching three slots in a stud is shown by Fig. 30. This consists of a fixture for holding the work, and a special broach holder to grip three broaches. Referring to the illustration, the work holder A is made of cast iron, and it has a hole B bored through it; in this hole the work is placed, the end coming against the plate C to locate it endwise; a plate D having a square hole cut through it fits over the square on the work; this plate also has a hole in it which fits over pin E, thereby locating the same radially. A hardened steel plate F backs up the broaches G as they are drawn across the work in the position shown, while at the opposite end the broaches are held by the block H and screws J contained in the cap K, all of which are attached to the threaded shank of the holder L by screws M. In this instance, advantage is taken of the square on the work, to prevent it from turning This makes a very substantial broaching arrangement, and the result is very smooth, accurate work.

Mention having been made of enlarging holes in hardened parts by the use of broaching machines, an example showing this class of work is illustrated by Fig. 31. The work is a sliding gear, and when hardened it naturally closes in unequally, owing to the uneven distribution of metal in its construction. To correct the hole and remove these inequalities, a broach similar to that shown below the work is drawn through it. This is simply a smooth bar having the entering end small enough to pass through the smallest part of the hole, and a gradually increasing portion which opens the hole to a size a few thousandths larger than the hole desired, so that after the broach has passed through it will spring back to the size required.

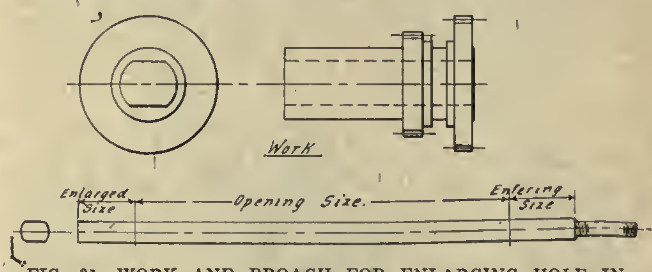


FIG. 31—WORK AND BROACH FOR ENLARGING HOLE IN HARDENED GEAR.

For broaching spiral holes having a long lead, a suitable arrangement can be made by locating a ball

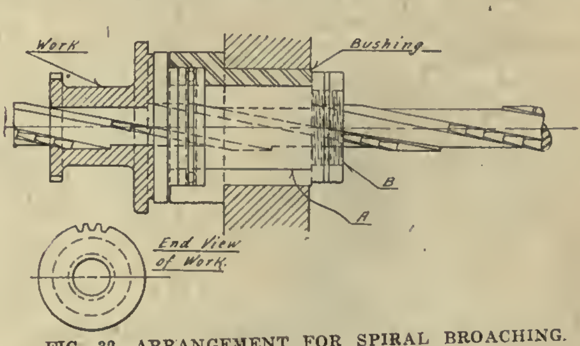


FIG. 32—ARRANGEMENT FOR SPIRAL BROACHING.

bearing thrust washer in a work-bushing similar to that shown by Fig. 32. This is so arranged that the work will revolve as the broach is drawn through it, and consists of a revolving pad A against which the work comes; check nuts B keep this revolving pad in the bushing, and the ball bearing takes the thrust of the cut in the usual manner. This makes a bearing which easily revolves under the cut, thus allowing the work to follow the angle of the spiral.

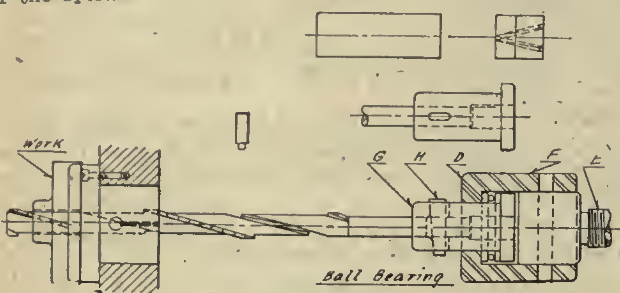


FIG. 33—METHOD OF SPIRAL BROACHING WHERE BROACH REVOLVES.

Another spiral broaching arrangement where the broach revolves instead of the work is illustrated in Fig. 33, and consists of the following parts: A work-holder A is held to the face-plate of the machine by screws B; this work-holder has a slot cut across its face, and the work being rectangular in shape is prevented from turning thereby. Two pins C are held in place by screws D, and these are flatted to fit slots cut in the broach, which pins are set to conform to the angle of spiral of the broach when they are in place in the

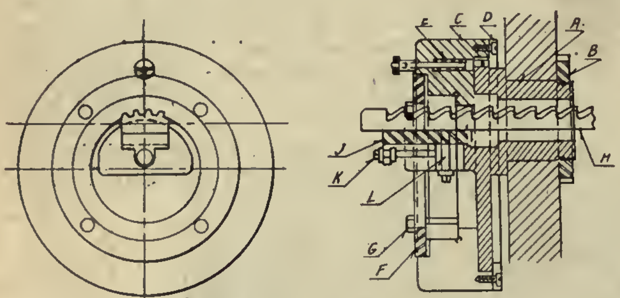


FIG. 34—METHOD OF BROACHING AN INTERNAL GEAR.

holder. The broach-holder shank E has a sleeve F over it, and this contains a ball-bearing thrust washer D in it; a broach-holding portion G having a head on it comes against the ball bearing, and thus the thrust of the cut is taken directly by this ball bearing. To hold the broaches in position, a key H passing through a slot in the broach is used. In operation, as the broach is pulled through the work, the guide pins C in the slots of the broach cause the broach to revolve as it is drawn through the work, and as the ball-bearing construction at the pulling end allows it to do so, spiral keyways are broached very nicely. At the lower left-hand corner of

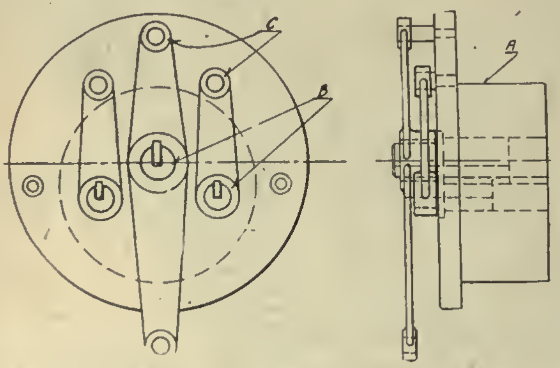


FIG. 35—FIXTURE ON WHICH THREE LEVERS ARE BROACHED.

this illustration, two views of the work broached are shown.

An indexing fixture used for broaching teeth in an internal gear is shown by Fig. 34. This is held to the face-plate of the machine, and is set off centre so the broach will pass through the centre hole of the machine. Referring to the illustration, the body of the fixture A is securely held in the face-plate of the machine by a collar B. This has a work-holding member C held to it by a strap D. A spring pin arrangement E locates this member C at ten different points about the centre. The work is held in place by a strap F and four bolts G. In operation, the broach H is passed through the work once and then returned to its starting point, following which the work is indexed in the fixture to the next locating holes successively until the broaching is completed. In this fixture a wedge J backs up the broach, and this has a slight adjustment for wear, by means of the screw K, while it is locked in position by a screw L.

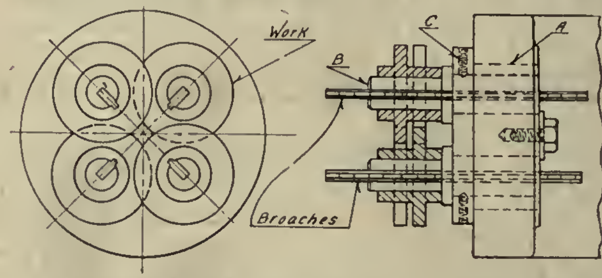


FIG. 36—EXAMPLE OF BROACHING FOUR OVERLAPPING PARTS AT ONE TIME.

For broaching large gears, a number of keyways and other parts which would require an extra-large broach, this method will often prove the most economical and sometimes the only practical method of machining.

The next two illustrations, Figs. 35 and 36, show examples of group broaching, both of which are keyway-broaching fixtures, one for levers and one for gears.

Referring to Fig. 35, this fixture A fits into the face-plate of the machine, and the levers are located on work bushings B and pins C, while three broaches are pulled through the levers.

In Fig. 36, the large bushing A contains four work bushings B, which are held in position by the screws C, and the broaches operate in the usual manner to cut the

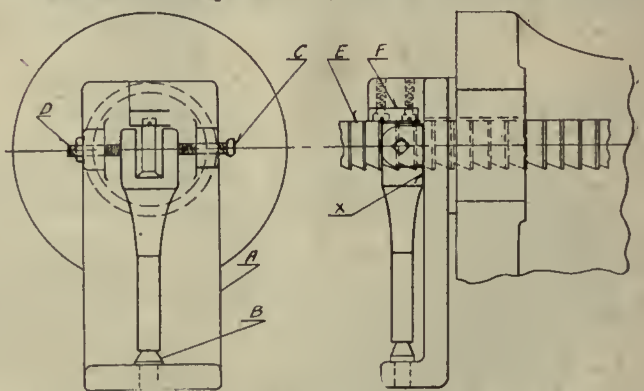


FIG. 37—FIXTURE FOR BROACHING LINK CONNECTION.

keyways. The gears held on this fixture are staggered, the short hub on one being arranged with the long hub on another so the gear portions will clear each other.

A fixture, in which a link connection has the slot broached in it, is illustrated by Fig. 37. This link has the centre hole drilled in it at the lower end before broaching, it otherwise being rough; this centre hole is used for locating purposes, as the body of the fixture A, which is attached to the machine in the usual manner, has a centre B in it, while a screw C holds the upper end lightly in position against the locating screw D; the work rests against the body of the fixture at X while the broach E is pulled through it. A hardened steel plate F backs up the broach during this operation.

Broaching a slot in the outside of a ring is accomplished very neatly by using the fixture shown by Fig. 38, where a cast-iron body A has suitable provisions made for holding a large ring while a broach B, supported in a guide-bushing C, cuts the slot. This guide bushing has a groove machined in it to support the work while a slide block D, operated by the screw E, clamps the work. This screw has a head on it which fits a counter-bored hole, while a plate F keeps this screw in place. The stud G has a tapped hole through it, and the screw E, operating in this hole, moves the slide in and out to bind the ring while, at the opposite side of the ring, a hook bolt H, with a hand knob on it, clamps the work against a finished seat on the arm of the body of the fixture. At the upper right hand corner of this

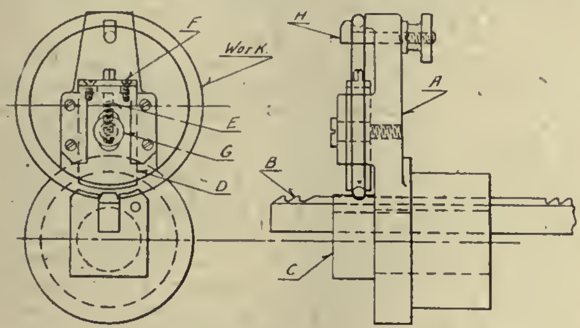


FIG. 38—FIXTURE FOR BROACHING SLOT IN RING.

illustration, a section showing the broached slot in the work has been drawn. It will be readily apparent that this fixture makes a very simple and effective method of holding the ring for this operation.

The purpose of the broach shown in Fig. 40 is to enlarge the holes in soft material and, by compressing the metal, give the holes a glazed finish, thus producing a harder surface than would be possible by reaming.

The two illustrations below this broach show typical examples of work handled in this manner, these being bronze bushings. The finishing teeth for this purpose are made slightly larger than the finished size of the

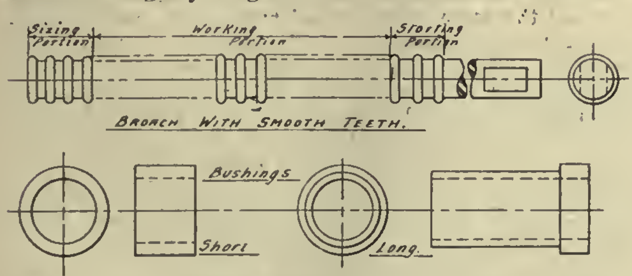


FIG. 40—COMPRESSION BROACH AND EXAMPLES OF WORK.

hole, to allow for spring in the metal, while the amount compressed is usually about the same amount as is allowed for reaming.

For broaching the two slots in the open end of a yoke, a fixture similar to that shown by Fig. 41 was used. The body of the fixture A is made of cast iron, and has a stem turned on it to fit the hole in the faceplate of a draw broaching machine; there is also a pin B for locating the work, while two screws C and two locating screws D, one against each arm, hold the open ends in position. The plate E slips between these open ends and into slots at both sides of the fixture, while two wedges, F and G, when driven into position, form a solid backing for taking the thrust of the cut as the broach H is drawn across the work. Two plates, J and K, back up and help to guide the broach, which forms the sides and radius at the same time.

This fixture is one of many which form a class for locating from finished surfaces to bring broached sur-

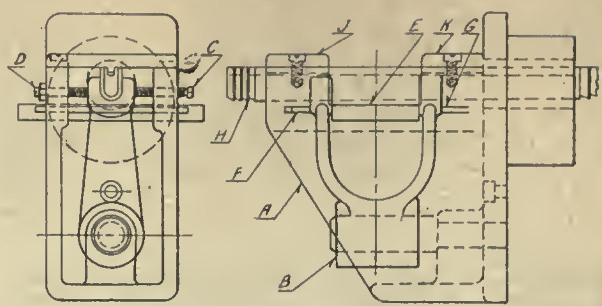


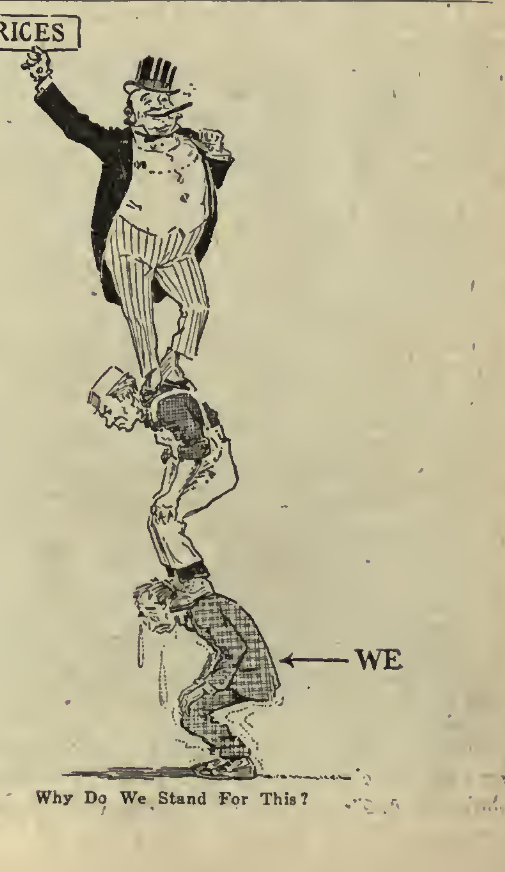
FIG. 41—FIXTURE FOR BROACHING SLOTS IN YOKE.

faces in line with them; they vary but slightly from the general run of work holding fixtures, the most important feature, in addition to proper locating points, being to hold the work rigidly at the broached points to counteract the severe stresses of straight line cutting.

During the repairs on a 1,900-ton drawbridge, located where the Lincoln Highway crosses the Passaic River near Newark, N.J., it was found necessary to remove the centre casting and pin, the latter being so tightly wedged that it was impossible to pull it from the casting.

After several unsuccessful attempts to draw the pin from the casting, below which it projected down 3 inches into the masonry, it was found necessary to cut a trench in the hard granite so that the casting might be shifted laterally to one side for removal and replacement by a new and larger centre casting. This trench was 4 feet long, 9 inches wide and 3 inches deep, extending under the old casting.

The cutting of the trench would have been an endless task had it not been discovered that an oxy-acetylene flame chipped the granite quite readily and could be used under the old casting without damaging the balance of the masonry. The desired channel was thus quickly obtained. The flame was also used for cutting away the abutment back of the fixed span bottom chord to provide expansion clearance. This work was under the supervision of T. J. Wasser, county engineer of Hudson County, N.J., and was done by the Bethlehem Steel Bridge Corporation, with Thomas D. Fulton as erection engineer.



Why Do We Stand For This?

The Day of the *Apprentice* Has Not Vanished

The Stratford Shops of the Grand Trunk Maintain a Merry Army of Young Men Who Are Thoroughly Schooled in the Working of a Locomotive

By A. R. K.

THE world moves, and the apprentice moves along with it. At least he does as far as the Grand Trunk shops are concerned. Apprentices used to start at 3.4 cents per hour, while now they begin to learn the why and why not of the mechanical world at the sum of 29 cents per hour.

The Stratford classes of the Grand Trunk shop have always held a premier position in the organization. It is interesting to notice the way in which apprentices line up and wait for a chance to get in there. In fact, it is somewhat of a relief to see the size of the classes and the calibre of the boys in them. It is not unusual to hear a manufacturer sigh and say: "We have no apprentices in our shop." In such a case one can almost with certainty put it down that apprentice training is not seriously considered in that shop. The shop that trains apprentices, that teaches them and uses them fairly is going to have a good supply of apprentices. The shop that wants an apprentice as a chore boy, or to get a day's work out of him after he has been around the premises for a week or so, is going to have a poor and a hard time trying to interest the apprentice. Such a shop has nothing to offer the boy, and the reputation of the place travels quickly and acts, as it should, as a signal and a warning.

In the first place the Grand Trunk apprentice must have a certain training before he is taken on. That eliminates right at the start the lad who has no particular interest in his work, and it gives the apprentice instructor, both in the shop and schoolroom, something to work on.

The Five-Year Term Again

The Grand Trunk are reverting to the old term of five years for apprentices. For some time they were put through in four years, but the change has come into effect within the last few weeks, and in the future the five-year period will be in force. The McAdoo schedule for railway employees is probably behind the scale that is paid now. Here are the amounts paid to apprentices per hour under the new scale. Along with it is given the scale for four years, which has just been abandoned:—

	Old Scale	New Scale
First six months	25	29
Second six months	27½	31½
2nd year, first 6 months	30	34
2nd year, second 6 months	32½	36½
3rd year, first 6 months	35	39
3rd year, second 6 months	37½	41½
4th year, first 6 months	42½	46½
4th year, second 6 months	50	54
5th year, first 6 months	..	60
5th year, second 6 months	..	69

The apprentice in the Grand Trunk shops has an option of the following trades:—

Blacksmithing.
Boiler Making.
Tinsmith and Pipe Fitting.
Pattern Maker.
Machinist.

It is hard to state with accuracy what percentage of apprentices go through for the various courses, but the last class named, viz., machinists, would embrace by far the most.

The Grand Trunk aprentice is looked after in the shop and in the class room. The shop instructor sees to it that the apprentice is moved on, that he becomes the master of every operation in the shop, and even though there are a large number of apprentices going through, there is no stinting with individual instruction. The day the writer was in the shops this was clearly demonstrated. One lad was on a lathe for the first time. He was not getting along—in fact, he was getting tied up. The instructor saw where the boy had gone wrong. He did not shout at him or "bawl him out." He simply did the thing that would help the boy most, viz., start right at the beginning, show him exactly how to put his work in and true it up and then set the tool, etc. The boy was not long before he was gaining, but the instructor was in no hurry to leave, and before he was done that lad understood that operation coming, going, upside down or sideways. I thought at the time that that might offer the explanation as to why there was always a waiting list of apprentices at the Grand Trunk shops in Stratford.

The putting of an apprentice along from one rate of pay to the next is accomplished by certain attainments on the part of the apprentice himself. The Grand Trunk shops are not run on any hit and miss basis, neither are the apprentices lost sight of after they are indentured. The full time must be made up in each period. That is, if an apprentice is out for a couple of weeks in his first six months, he must make up that time before passing along to the pay of the next six months.

In the Classes

The Stratford shops have class rooms that are ideal for all the purposes of apprentice instruction. The rooms can be thrown into one large assembly hall, and social gatherings are frequently held for the boys.

In a general way the first year's instruction in arithmetic takes in addition, subtraction, multiplication, division, and the same work applied to decimals, vulgar fractions, etc. Percentage is also included in the first year apprentice work.

The second year takes them into involution and evolution, mensuration, triangles, circles, rings, cylinders, solids, cubes, ratio and proportion, while in third year work the apprentice passes to the more advanced forms, such as equations and formulae, transmission of motion, pulleys, gears, lathe gearing, uniform motion, horse power, steam engine, friction, etc.

What a Difference

Do the Stratford shops turn out good mechanics? Well the Stratford shops have a reputation for turning out a tremendous lot of good work, and good work and good mechanics generally travel along together. Mr. Robb, vice-president of the Grand Trunk, is a graduate of Stratford, so was Mr. Maver, late superintendent of the Montreal shops, as well as Mr. George Wilson, the present holder of that position. Mr. Battley, superintendent of the Eastern lines, was also trained at Stratford, and Mr. McDonald, assistant superintendent of the Montreal shops, is another. And Mr. Jos. Chidley, general superintendent of the Lake Shore Road, comes on the same list. Mr. Robert Patterson, now retired, but for many years master mechanic at Stratford, also came up through the Stratford shops.

J. C. Garden, now superintendent of Motive Power at Stratford, was a Stratford apprentice. "It's quite a bit different learning a trade now to what it was when I first came here," remarked Mr. Garden to CANADIAN MACHINERY. Mr. Garden, by the way, talks to the interviewer, gives instructions to clerks, answers the phone and pushes buttons all at the same time. In other words he's a busy man and the Stratford shop is a busy place. Mr. Garden has "growed up" with the Grand Trunk—in fact he was a foreman at the age of 21, and he's been going ever since.

But to get back to the brand of days that existed when Mr. Garden started to find out the mechanical wherefore of the Grand Trunk shops. "Let's see, we used to get in those days a scale that ran something like this—First year, 3.4c per hour; second year 4.5c; third year, 5.6c; fourth year 6.7c., and fifth year 7.8c. After that, if the apprentice turned out to be a very good mechanic he got 15 cents per hour, but if he didn't the chances are that he was let out. That's quite a difference to the scale as it stands to-day. Starting now at 29c against 3.4 and ending at 69c against 7.8. It's hard to say if the apprentice is any better off on account of the higher wages. It works differently in different cases. An apprentice on the present scale can really become self-supporting and more or less independent of home influence or restraint. This does not often happen, but it can.

"Of course there were no classes for mechanical drawing or arithmetic in my apprenticeship days," continued Mr. Garden. "I can remember when about a dozen or so of us decided to study drawing. We bought our own material and drawing supplies, and then paid for our teacher. That cost as near as I can remember about $1 per month. Not much, you say. Well, when you consider that apprentices then were earning about $6 a month, it was quite a sum. But for all that they always had an apprentice waiting list about a mile long.

"Then there was a class organized by some of the apprentice boys who wanted to study arithmetic. No classes then on the company's time. We hired a room down town and engaged one of the school teachers to come there at night. Then there was something else to consider," remarked Mr. Garden, "the place had to be heated. We used to put our own fires on, and after the room had become sufficiently warm the class would commence. The woodpile that we had in connection with our school was a mark for someone in the neighborhood and we had a merry time of it trying to keep track of our supply of fuel."

But the apprentices of the day when Mr. Garden went through were going to master shop arithmetic and mechanical drawing, and they did. Speaking of drawing brings to mind an incident told me at the Stratford shops. It shows the interest Mr. Garden still feels in the boy who wants to get along. An apprentice, a returned man by the way, had been working studiously at home trying to get a drawing in shape for the Exhibition, when word came placing the closing date at a time that would make it quite impossible for the boy to get his drawing in shape, as it was an extensive affair, with a very large amount of detail involved. Mr. Garden heard of the incident, called the apprentice to his office, and inquired about the drawing. The apprentice informed him that it would not be possible for him to get it done in time.

Asked as to how long it would take, the answer was that a couple of days "if laid off," would see it done. Whereupon Mr. Garden informed the ambitious draftsman that he was to use the drawing room at the shops, and stay with it until he was finished, and that no time would be lost.

Time was when Mr. Garden looked in directions quite separate and apart from the railroad shops. If one were to go back far enough it would probably be found that the parents had a Scotch Presbyterian pulpit picked out for him, while not many years after Mr. Garden had a law career mapped out for himself. As a matter of fact he read law and studied shorthand at nights, preparatory to studying with one of the Toronto firms. The law was a poor trade just then, however, and a number of very capable lawyers were seriously and anxiously looking for something to do that had a real meal ticket hitched to it. So it was that Mr. Garden was lost to the pulpit and the bench, but he found his element in the railway world.

The Days of Shop Secrets

"A boy going through our training," remarked Mr. Garden, "learns a real trade. If he applies himself and

WHO SAID THE DAY OF THE APPRENTICE HAD PASSED?

THE 1919 APPRENTICE CLASS AT STRATFORD SHOPS OF G.T.R.

takes advantage of all the opportunities here, he can go out nothing short of a mechanical engineer. There is a great difference in what the apprentice can learn now, and the ease with which he can learn it. The day of the trade secret has passed away. For instance, the setting of valves on the locomotives used to be a real secret. It was so much so in years gone by—and remember, I am speaking of a number of years ago—that one of the foremen wanted to watch an old hand setting valves, and so informed him. He was greeted by something like this:—'You get to —— out of here. If I'm going to set valves you're not going to watch me. I paid well to learn that trick and I'm not handing it out free.' The upshot of the thing was," laughed Mr. Garden, "that the foreman had to get out while the old man set the valves."

The apprentice in the Grand Trunk shops does not have to work long now before he has a chance to become familiar with slide valves. It is not the policy of the shop to have any secrets. They want men who know the locomotive, valves and all, and nothing is held back from the boy who wants to go ahead and learn.

More Attention Needed for the Average Boy

If one were to ask Robert Patterson, formerly master mechanic at the Stratford shops of the G.T.R., what part of his life work had had the strongest appeal to him, my guess would be that he would say "The apprentice classes." Mr. Patterson is now superannuated, but has not lost any of his interest in the work to which he gave the best years of his life.

Although Mr. Patterson did not start his apprenticeship at Stratford, he completed it there. After going through the Model School at Toronto, he entered the Grand Trunk shops at Montreal in 1874, but went to Stratford three years later. Becoming a journeyman, Mr. Patterson went to the big Baldwin works, returning in 1882 as foreman of the machine shop at Stratford. He was made general foreman of the Midland Railway at Port Hope the same year, and from 1883 to 1887, was locomotive foreman at Montreal. It was in 1888 that Mr. Patterson was made general foreman of the shops at Toronto when the G.T.R. got possession of the Northern and North Western Railway. Acting assistant master mechanic at Gorham from October to December, 1896, and in 1897 general foreman of the Port Huron shops. The same year Mr. Patterson was made master mechanic of the lines west of St. Clair River. In February of 1899, the Grand Trunk made Mr. Patterson master mechanic of the Stratford shops. He retired, on the advice of physicians, almost two years ago.

Such, in brief, is where Robert Patterson has been, but it does not record what he has done. You hear much of the latter from the apprentices—now mechanics, and good ones—who came through the shops under his direction. To all these he was not merely "the boss," but more. He was their friend—their ideal of what a real railroad man should be.

I spent an afternoon with Robert Patterson in his pleasant home at Stratford a few weeks past. We talked of many things, but no matter how far astray we went, it was not long before the drift was back to the question of a real chance for the average boy. Not the boy whose parents could school him to the limit by their wealth and position, but the average boy, the lad who had, sooner or later, to get out and make good off his own bat.

"The ordinary man is the one we have to deal with," is Mr. Patterson's starting point. "I have my doubts if we have ever done enough in our schools for the ordinary

ROBERT PATTERSON
For 20 years master mechanic of G.T.R. at Stratford—now retired.

boy. We are making it possible for the best technical schools to be cornered in the cities, and it becomes almost as great an undertaking for a father to send his boy there as it does to give him a university education. Sooner or later we must realize the necessity of looking after the boys who live in the smaller centres. We must prevent them as much as possible from drifting out and growing up as laborers."

"Well, how would you go about it?" I asked.

"Schools right in the shops," was the answer of Mr. Patterson. "Have trade schools with travelling teachers who are specialists in their lines. Let shops in similar lines of work in a district come together for this purpose. The apprentice who goes into a shop has a right to know what he is going to get there. That shop has the boy in those important years which are going to determine largely what sort of a man or mechanic he is going to be in after years. Every apprentice should be educated along the lines that he is going to work on in after years. If this is done what happens? The boy becomes an intelligent apprentice, he turns out to be a first-class mechanic, with sufficient knowledge to enable him to go to be a foreman, a master mechanic or superintendent. What do the shops and factories get out of it? A better class of mechanics, a better output and a satisfactory supply of skilled men. Give the boys the very best teaching of the things they are going to need in shop practice, and be careful to cut out the things they will not need. Make a drive on the subjects that men have had to work nights to learn."

Mr. Patterson holds firmly to the belief that we have no right to shape our schooling so that the advantages will be for those who are able to go to our higher schools of education. "The average boy is the lad we have to deal with in nearly every case," is his idea, and it's hard to see where one is going to find good reason or ground to dispute this claim.

But what of the apprentice who enters a shop where he is going to get a training worth while? Mr. Patterson does not by any means favor the building up of any jug-handled arrangement by which the apprentice would have nothing to do but come in and take advantage of the training.

"Keep up the standard of the shop. Keep up the standard of what the boys must know before that shop will take them in, and you will find you are doing a lot to raise the standard of the whole community. Boys should not be allowed to have a period in between the time when they leave school and when they begin to learn their trade. Any man who has dealt with apprentices has seen this work out. A boy leaves school as soon as the school age allows him to do it. He starts out to look for a job—commendable, no doubt. But what happens? He spends a year or so driving a grocery or a butcher rig before he realizes that he has made a mistake, and wants to learn his trade. In that year he has had little chance to use what he learned at school. His asset has been his knowledge of the streets and houses in the town or city and his ability to drive a horse. When he starts in a machine shop, he really knows less, from that point, than when he left school. A good examination, fairly stiff, based on the essentials, should be the starting point of the apprentice. Make your training worth while, but let the boys understand that they have got to come up to the scratch in order to qualify, and they will come."

CENTERING LARGE SHAFTS WITH A PNEUMATIC DRILL

By F. A. McLean.

In many shops it is sometimes necessary to centre shaft or other pieces of machinery which are too large to be readily handled on an ordinary centering machine or in the lathe, and where machines of sufficient size are in use, the time consumed in lifting the pieces to and from the machines is often an objectionable features To anyone who is confronted with this problem, the following description of a pneumatic centering rig used by a large manufacturer in the eastern part of the United States to centre large shafts may be of some interest.

The size and weight of the shafts made handling costly, and in view of this fact it was thought that some form of portable centering equipment would be of value. A number of methods of doing the work were tried out and abandoned for one reason or another, until the pneumatic centering device shown in the accompanying illustration was worked out by the company's engineers.

From a little study of the photo, it will be seen that this centering fixture consists essentially of a pneumatic drill supported in a cradle formed by screwing steel rods into the back of a three-jawed universal chuck. The rods were placed in such a way as to prevent the drill from turning, and were fastened at the free ends to a round steel plate. The star feed wheel which is usually fitted to air drills was removed, and a round hand wheel with a rolled edge used in its place. In operation the chuck end of the device is slipped over the end of the shaft to be centered, the jaws are tightened sufficiently to resist the thrust and the drill is started. After drilling to the required depth with a combination drill and centering tool, it is only the work of a few moments to loosen the chuck and go on to the next shaft which may be of the same or another diameter, as the universal chuck readily permits shafts of various diameters to be centered without the use of bushings, etc., and with full assurance as to the ultimate concentricity of the hole. The entire device being light in weight, easily handled, and speedy in operation has proved of great value for this work.

USING THE CENTERING OUTFIT DESCRIBED.

According to the "Engineering News Record, a superintendent was annoyed to find that a crew of carpenters did not attend to their work properly, while a derrick was periodically swinging its load over their heads. The men invariably stopped work to watch the loads pass by. A canvas awning was stretched over the carpenters' benches. This was obviously no protection at all against a falling object; nevertheless, it served its purpose, because the carpenters were unable to see the work of the derrick, and although they knew that the loads were passing over them, they did not stop and stand ready to dodge if the derrick should let go. This device resulted in the saving of 10 per cent. of carpenters' lost time.

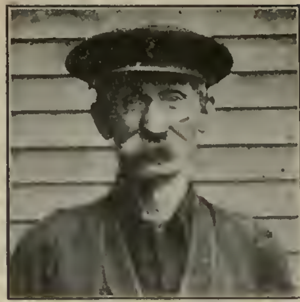
Reed Small Tool Works, Cherry Street, Worcester, Mass., are sending out their new catalogue, No. 4, in which a revision of list prices is noted. This booklet, consisting of forty pages and twenty half-tones, covers the Reed line of micrometers much more fully than any of their descriptive matter heretofore issued, and shows a greatly broadened line.

JOHN PATTERSON

Mr. Patterson came with the company at the age of 46, and spent 29 years in the lumber yard and Saw Department.

GEO. IRWIN

He retired at 77 years of age, with 19 years' service to his credit, most of which he spent as an expert.



HARRY PAYNE

For nearly 32 years in the No. 1 Machine Shop. Now 70 years of age, with the Massey-Harris Co. for 32 years.

JOHN VALENTINE.

Of the Knife Department, retires with 22 years' service to his credit at the age of 71 years.

WM. LOWRY

Ten years at Brantford shops, then in Toronto. He has served 38 years here, making 48 years in all.

HARRY FRICKER

For 32 years employed in No. 1 Machine Shop, retires on the Pension Fund. Harry wears medals for Fenian Raid and long service in militia.

After They Have Done Their Bit

ALTHOUGH there are no actual figures prepared yet, showing on what basis the pension scheme will be operated, about thirty of the employees of the Massey-Harris Company have gone on the pension list, provision for them being made temporarily out of the capital of the company. It was in April of 1919 that the directors approved of the idea, and, although there has been a lot of investigation carried on, the plan to be ultimately adopted has not been completed. The matter is now in the hands of a firm of actuaries, and on their report, if it is feasible, will be based much of the machinery for putting into effect the pension fund of the Massey-Harris Company.

So far the pensions are running from $25 to $40 per month, depending largely on the length of service. In time, when the whole plan is worked out, there will be a definite statement, put down in black and white, and the man entering the employment of the firm will know exactly what he can expect in the way of pension.

The Ideal System

Mr. J. N. Shenstone, first vice-president of the Massey-Harris Co., discussed the matter at some length with a representative of CANADIAN MACHINERY. "The ideal pension system," said Mr. Shenstone, "is not one that provides for the man in his old age only, but goes on and provides for his dependents. "I'll grant that such a thing takes a long time to work up to, but it is coming. We want the men here, when they come to the point where they are entitled to a pension, to feel that they are not getting anything in the shape of charity. We want them to realize that they have, through their years of service, earned the pension which they are starting to receive, and that they have a perfect right to it."

Where It Does Not Work

Mr. Shenstone went on to speak of the experiences of other places that had worked along these lines. One instance came up where not long ago an employee of a certain shop was urged to go on the pension list. He did not like the idea of quitting work. Like many another man he still held to the belief that he could still hold up his end in a day's work as well as when he was twenty-five years of age. The result was that one day, after walking home and feeling very much exhausted by an extra effort on account of the failure of transportation facilities, he dropped dead shortly after reaching his home that evening. Now, the pension, had he taken it, would have helped him very little. The persons needing help are those who are left without the earning power of the bread winner.

"So far," stated Mr. Shenstone, "we are simply making provision for pensions out of a lump sum set aside by the shareholders for that purpose, but we intend to have a fund invested for the purpose, and use the interest to sustain the pension fund. That is the only way to put it on a substantial basis.

PATRICK HARDING

For 21 years in employ of Massey-Harris, lately on elevator in Cream Separator Department, retires on the Pension Fund at age of 73.

ARTHUR WALL.

Retired under the Pension Scheme, at the age of 68, after 30 years' service, mostly in the Malleable Department.

LEVI DAY

Retired under the Pension Scheme, at the age of 75, after 20 years' service, mostly in the Malleable Department.

JAS. RICHARDSON.

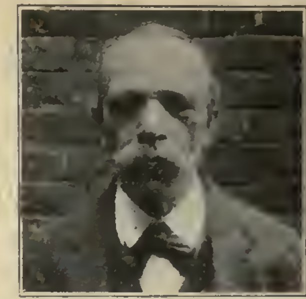
As repair man in the machine shop, Mr. Richardson was 32 years with the firm. He is now 70 years of age.

HENRY DUNSFORD.

Now 77 years of age, was in the Construction Department at Toronto for 17 years.

WM. WATSON

Sixty-three years of age, 36 of which he spent as an expert, starting in with A. Harris & Son at Brantford. Mr. Watson was taken ill with paralysis last March, but recovered.



FRANK PALSER

He retires under the Pension Scheme at 67 years of age. His record is 36 years' service in Nos. 2 and 3 Machine Shops.

THOS. BUXTON

Retires on pension. Owing to Mr. Buxton becoming blind through cataracts he was only able to give us 13 years' service in the No. 3 Machine Shop and on the elevators.

"Will the men have anything to do with it?" asked, CANADIAN MACHINERY, "that is, will they be asked to pay anything into a pension fund?

"Not at all?" replied Mr. Shenstone. "We are not going to ask the employees to pay. We consider that the best form of pension is one that is provided by the company out of its earnings."

THE INDUSTRIAL COUNCIL

Some time ago the Massey-Harris Co. introduced the industrial council idea, an account of which was given in the July 31 issue of CANADIAN MACHINERY. At that time it was in its experimental stages, and only actual experience could show its worth or weakness. An official of Massey-Harris Co. stated just a few days ago that they were well pleased with the way in which it was working out. "The chief thing is this—the members of the council, while at work in the shop, can head off a good many disturbances that might go further, and that is a great consideration. When you can get the men in the shop to believe that they have recourse to an independent body, and that no shop prejudice is working against them, you have something worth while. Just a few days ago a mechanic applied to his foreman, stating that he considered he was entitled to an increase in wages. The foreman could not see it that way, claiming that the next raise in that department should be coming to the assistant foreman. The man was, of course, disappointed, and went to the shop representative of that department on the industrial council, who in turn got in touch with the superintendent. The result was that the three, the shop representative, the foreman, and superintendent settled the matter in a few minutes. It is splendid work to get these things attended to at one, because no man, either in the office or the factory, can do his best work if he considers that his application for wages or for the readjustment of any grievance has simply been side-tracked.

Stock Selling to Employees

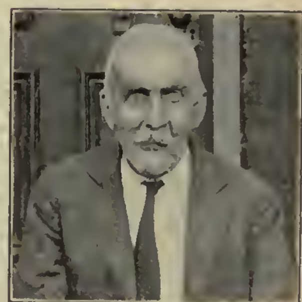
Progress is also being made in regard to selling stock in the company to employees. There seems to be a very fair way in vogue. For instance, if a person subscribes for an allotment of five shares, he is credited with one share paid-up just as soon as 20 per cent. in paid, whereas in many stock propositions it is withheld until fully paid up. Glancing over the stock list of the Massey-Harris Co., one is impressed with the number of names that can be checked off as being actively in the employ of the company.

The Victory Loan has interfered to some extent with the work, but now that is over it is anticipated that stock buying in the Massey-Harris Co. by the employees will be gone on with more aggressively than ever. The number of shareholders is increasing, now being not far removed from the five hundred mark.

The Massey-Harris Co., in common with other large industrial concerns, have had a great deal of valuable time taken up in the last few months with securing sufficient steel and iron, and more recently coal for the operations of their plants.

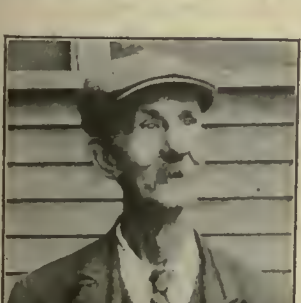
WM. SHERRIF.

Retired at the age of 69 with a record of 35 years to his credit. Most of this time has been spent in the Shipping Department.



JOHN D. HENTIG

He is now 74 years of age, for 15 years with the company, in the Scratch Iron Department.



BENJAMIN FINNIE

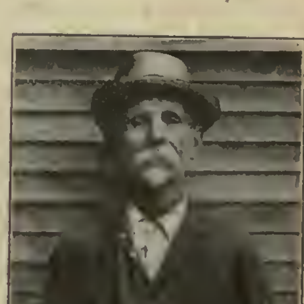
Here's a record, 48 years, almost half a century—mostly in the Paint Department. Mr. Finnie has retired at the age of 75.

THOS. BARNETT

He is 78 years of age, for 24 year in employ of Massey-Harris as a painter. Mr. Barnett has been sick and unable to be at work since 1913.

ADAM MURRAY

Retires under the Pension Scheme. He is 72 years of age and has served 26 years in the Shipping Department and on various elevators.



J. H. MASON

He has 37 years' service to his credit. Mr. Mason was a genial deaf mute—a familiar figure in No. 1 Machine Shop—respected and liked by all.

The *Personal Touch* Worth Cultivating

How the Jeffrey Mfg. Co., With Their 4,000 Employees, Get Along Without Strikes—Aim to Make Man Get the Work He Likes and is Fitted For, and Find It Pays

By S. S. MOORE, Canadian Machinery

IN these days of industrial unrest, the question that pushes itself to the front is, "What is the solution?"—and out of the desperation of it all there seems to be developing on the part of the employer and the employee the recognition that each possesses all of the elements of heart and head—and soul—that go to make up a human being. There is a call for confidence, for inter-responsibility which must resolve itself into co-operation on a common sense, business-like basis.

The Jeffrey Manufacturing Co., of Columbus, O., have investigated, experimented, developed and applied the personal touch among their 4,000 employees. That little phrase "the personal touch," is not a stranger; it has been recognized in many changes of raiment, has been camouflaged, overworked and misunderstood, but still it represents factors that contribute to good business and that can be applied thereto in a practical way. The Jeffrey Co. are applying it, not by any means as a cure-all, nor do they claim that its adoption in different lines of co-operative interest will cast aside human frailities and misunderstandings, as apparent in the industrial world. Still, it is evident that the personal touch works effectively toward ironing out the problems that are everywhere retarding good business—that is, good business for the employee as well as for the employer.

New Sphere for Woman

Sweeping aside the altruistic bung that so often hedges around the so-called welfare work of the present day, the Jeffrey people recognize that, in dealing with men, there are three fundamentals that must claim first consideration. These are, wages, working conditions and the square deal.

By paying better wages, they secure the better class of workmen, and this in turn leads up to higher standards of efficiency, superior workmanship, more satisfactory production.

By the way, a man applying for a position with the Jeffrey people, does so to a young woman, pleasing, tactful, but with an intention which seldom errs in an estimate of the applicant. The reason is plain but seldom appreciated by employers of labor. Inquiry proves that when an applicant first meets a man, and is asked for certain particulars as to his record, skill, etc., there is almost invariably set up a sense of resistance, a prejudice which damages confidence, if it does not induce deception. On the other hand, it is seldom that an applicant will be anything but truthful when confronted by a young lady; he will not hold back any useful information, and his confidence is obtained to a degree that would hardly be possible under other circumstances.

Having been successful in his application, some attention is paid to the man's adaptability. The Jeffrey Company are manufacturers of mining machinery and the assignment of men throughout the different departments is not done in a hap-hazard way. The newcomer is placed wherever he feels he can best make good. He is not driven into a location for which he is little fitted and for which he has little heart. The idea is that from the outset, he is made to feel that he has a position in which there is scope for his ambition and in an atmosphere that is friendly, helpful, rather than antagonistic. The efficiency system of the organization is such that the man's wages are advanced according to improvement in his work.

Every Liberty to the Worker

There is no paternalism about the Jeffrey plant. It is one that helps the employee help himself, thereby setting up a co-operation that works for the benefit of the entire organization. Should an employee feel that he has a grievance it is his recognized right to appeal—to his foreman, to the works superintendent, to the general superintendent and so on up to the general manager, if he so desires—and certainly no impediment is put in his way. His reasons for withdrawing from the service, if it comes to this, are very finely sifted and given sympathetic consideration. Of course, some withdrawals are unavoidable—rank insubordination, domestic troubles, climate conditions, etc.—but this matter of eliminating the floater in labor turnover has its merits from the viewpoint of good business.

It has been established by actual investigation that the labor turnover in industrial plants throughout the United States is something like 250 per cent., that every withdrawal from the force means an average cost to the concern of about $80. That is to say, some 3,500 men are hired during the year to maintain a permanent force of one thousand men—and that every withdrawal means a loss of $80. When this fact is brought home to the average employer of labor, he is dubious. He has never looked at the labor turnover from that point of view. The going and coming of men is all in the day's work. He fails to realize that a temporary employee is by no means a producer, that permanence is the one factor that makes him a paying investment. By careful selection, by the most agreeable working conditions, by the application of the square deal—in short, by setting up the elements of contentment and confidence the Jeffrey people have reduced their labor turnover from 250 to 40 per cent. The saving thus affected certainly is good business. In the forty years of their history there has been one strike—about twenty years ago—but this was due somewhat to a misunderstanding and at a time when the personal touch had not been developed.

How to Go About It

In a recent address on "The handling of men," Mr. W. A. Grieves, assistant secretary of the Jeffrey Manufacturing Company, stated: "Our work has been from the men to the company, and not from the company to the men. We have avoided, as far as we could, all evidences of suggestion that we might have paternalistic motives. The average man is at once more or less suspicious of any attempt to hand him something for which he is not looking. He assumes the attitude of one who has to be shown—shown that you are dead in earnest—and this requires time and patient effort on the part of the employer. If anything new is to be introduced, get hold of the leaders—those fellows whose intelligence is most developed. Having gained their favor, the less thoughtful will fall in line."

In the Jeffrey organization particular attention has been paid to the situation of foremen, for as the foreman so will be his men. Big, broad-minded workmen will not be content to work for a department head whom they cannot respect. Men unconsciously gather about them men of their own viewpoint and disposition. The elimination of the policy of hiring and firing and the adoption of a policy of education is, from the standpoint of good business, the approved procedure for modern industry.

The Mutual Aid Association

In the various plans adopted by the company by way of encouraging employees to work out their own problems, there is again seen the principle of mutuality. In the beginning, of course, there was placed at the service of the men someone fitted to lead men and to help them in helping themselves. In all activities fostered and encouraged by the company, the management and organization has been carried on entirely by committees of shop men. They have their Mutual Aid Association, a $20,000 employees' restaurant, an employees' grocery and bakery, the latter with a capacity of four thousand loaves per day. There are clothing, dry goods and boot and shoe departments. In connection with the meat department, butchering has been successfully initiated, and lard rendering, sausage making and the killing of poultry have been the means of considerable saving to the men, and needless to say, there is no profiteering in connection with this cooperative store, in which the business amounts to about $25,000 each month. Agricultural products are handled in a large way, and there is a regular auto truck and wagon delivery service.

How They Solve Housing

Some ten years ago a building and loan association was formed. The result is the erection of over four hundred houses—modern, comfortable, homelike houses—owned by employees. The Association's operations last year were to the extent of a million and a half dollars. It has paid a dividend of 6 per cent. and has loaned the money for a lower rate than is paid elsewhere. The company advanced the money to start the Association, but it has all been paid back—a matter of helping the employees help themselves.

"Jeffrey Service," a monthly publication in the interests of the entire organization has done much to weld together various elements of factory, shop and office life. Its columns are made up of the main events of human interest to all of the organization. Pictures of the beautiful homes, the winsome children and babies, Jeffrey salesman, branch offices, records of parties, editorials and special articles go to make up a most interesting periodical. The paper has its regular staff and as the bulk of the material is contributed by the men themselves, there is never a dearth of copy. The paper reflects Jeffrey shop and home life vividly.

Insuring the Employees Now

Recently there was inaugurated by the company a plan of insurance to cover all those who have been in their employ over a year or more. A very extensive study was given to the subject before its adoption. The ideal plan would be for each employee to pay his own insurance, but the fact remains that they do not do this and as a result their dependents do not have the protection they should. One good feature about the group insurance plan is that it gives protection to all employees whether they can pass a physical examination for ordinary insurance or not. Moreover, such a large quantity of insurance, based entirely on the law of averages, can be bought at a very low rate—an average of about $13 per thousand.

All those who have been in the employ of the company for one year, are insured for $500; this insurance increases $100 each year for the next four years, at the end of which time, the completion of five years' service, the amount is automatically raised to $2,000. It continues to increase $100 per year for the next 20 years until a total amount of $4,000 is reached. This plan is based on the idea that there is at least a certain consideration in length of service which justifies the company, in paying for it the way the plan provides. The inauguration of group insurance as described is not looked upon by the employers as any great panacea for stability within their organization, but they believe it will be an important factor. It will tend, as other activities have, toward a better understanding between management and co-workers as well as providing a very helpful agency toward security in the family relationship.

In all of these undertakings—the Building and Loan Association, co-operative grocery, restaurant, hospital, dairy farm, etc.—the same idea is in mind, that it is profitable to encourage and help men to help themselves and their ability to do things other than the mere routine of the daily work for which they are paid in money.

Commenting upon the insurance plan, as described, the Christmas number of "Jeffrey Service" had this to say: "The insurance is provided without cost and no medical examination is required. Further, it does not interfere with any payments under the Workmens' Compensation. Since the plan was announced there has been a constant expression of approval and appreciation on the part of all co-workers. We see in this insurance another evidence of the willingness of all of us who work here together to make it a safer, more secure and better place to work. We know that the expense involved will be more than accounted for by the increased service of every one of us. It is purely a business proposition and we know that it will pay. Those of us who know anything of the spirit behind everything that we have undertaken here together, know that our interests must always be that of mutuality —none of us can truly and permanently succeed unless we strive for the success and welfare of all. It is this attitude that has made Jeffrey what it is; and it is going to be the perpetuation of this idea that will make secure our future."

Confidence is the Keyword

Mr. W. A. Grieves, assistant secretary of the company, is a former Canadian. His boyhood home was near Meaford. He has made a careful study of conditions surrounding and created by modern industry, and is a strong believer in the application of common sense and sincerity in working toward workable solutions in industrial problems. "Confidence," he declares, "is the last word. The biggest wages, the best working conditions and an honest effort to divide the profits fifty-fifty won't even satisfy The whole question has a more fundamental element. It goes deeper than any one or a thousand methods. It has as its rock bed, confidence. It has as its superstructure a combination of all those factors that make for good will. And these cannot be catalogued. They are found in the hearts of men who have learned to play the game fairly. They are nurtured in the atmosphere of harmony, which, in turn, is nothing but the culture bed of efficiency."

A device has been constructed by an automobile manufacturing firm in its own shop for testing the properties of lubricants. The machine is built on the following lines: The chief part is a pendulum hung on a bearing which is supported on a shaft rotated by means of a pulley. The bearing is composed of two brasses to which pressure can be applied by a spiral spring inside of the pendulum. The pressure regulation is effected by a milled-head screw. When the shaft is rotated the friction between it and the brasses causes the pendulum to set itself a certain number of degrees out of the vertical and this distance together with the pressure on the journal give an indication of the friction, from which the friction-reducing value of the lubricant between the shaft and bearing can be determined by consulting a calibrated scale.—"Scientific American."

WHEN one reads of the plight of Austria—in need of credits, of grain and almost everything—it is not hard to see that one word "production" sticking up in Canada as the slogan for 1920.

Business of *Selling* an Interesting One

The Ideal Time to Start is Around 16—Get Bright Boys and Train Them Thoroughly—How Does the Outside Man See the Inside Organization at the Head Office?

By A. R. K.

IS there an opening for the young men of to-day to go in and study seriously the business of selling machine tools? How many successful, high-class machine tool men do you know? Not many. Do you see many of them out of employment? Or do you ever hear the remark, "Do you know where I can get a good salesman?" The latter many times more than the former.

CANADIAN MACHINERY discussed the matter at some length with Fred. W. Evans, Toronto manager of the Canadian Fairbanks-Morse Co.

"The best time to get a salesman," said Mr. Evans, "is when he is a boy of 15 or 16. Get the chap that has come from a good, thrifty home, where the value of money and time is known. Get a boy who is not too smart or too much advanced to go to Sunday School—get that boy and make your start with him. When the boy is ready to sell for you some years later, he will know your business thoroughly. He will have been brought up with it. He will know definitely and intimately the ways and methods of your firm. You have a chance to work with him during the years when he is willing to receive impression, because, unfortunately the time comes for many people when that period has passed.

The Man Who is "Just" Too Old

"THEN there is the young man of twenty who comes in and applies for a position. He has had some experience in selling, perhaps in a store, and he is quite certain that inside of two weeks or so he could get out and sell machine tools. Imagine a company putting a two-weeks man up against the average superintendent in the larger factory. He would stand a great chance, but still they come in that way. They have passed the stage where they are willing, or where they can afford to work for a small wage. They cannot start where you want them to start. They cannot work in the warehouse, from which they should naturally come on to the sample floor. We do not encourage the young man to come on with the idea of getting out on the road as a salesman in a short time.

"Then in the third class, and quite a large one, too, is the man of 35 or 40 who begins to realize that he has not had enough direct drive in his life—that he has wandered around too much, and has failed by not concentrating his effort. He realizes that he has got to make his stake pretty soon, and very often he is most persistent when asking for a chance. Some of these men, especially if they have experience in certain lines that the firm can commercialize, make good salesmen, but that is not the rule, it is rather the exception to the rule. You will find in nine times out of ten that a man at forty is set in his ways. He has his own ideas as to how things should be done, and he has his own ideas as to how machinery should be sold. The average firm does not want to take a man on with a view of training him after he has gone past the period where he is susceptible to training.

The Real View of the Salesman

"THERE used to be a belief that the successful salesman would have to be a mechanic himself, and that he would have to be the mechanical master of the line he sold. A general knowledge is necessary, but it does not follow that a man has to be a high-class mechanic in order to sell successfully. If he runs into problems that are too deep for him he can always draw on the company he is selling for, and experts can be quickly secured. The biggest thing a salesman has to think about is this:

"'What does my customer think of me?'

"The customer may be in a centre away from your head office. He may never have seen your head office, your factories, or any of your plants. For the time being all he sees is your salesman. The salesman who is going to succeed must get that idea behind him and ahead of him all the time. He has got to measure up to the size of the company. His big job is not selling a machine, or some other article, not simply taking an order or chasing up a prospect. His real worth-while work is to sell the company to the man, and that is a big enough job for any man to tackle, and the man who can do it successfully and consistently is going to succeed, and it will be difficult to keep him back."

"And do you think," CANADIAN MACHINERY asked Mr. Evans, "that there is future enough in the machinery business to warrant a boy going into the business as a life work, expecting from it as good a chance at advancement as he could gain by investing his time elsewhere?"

"I certainly do," was the reply. "The business of selling in the mechanical field is a big proposition, and the field is not crowded. There is room for competent men, and there will be more room in the future as the industrial developments in this country become more marked."

How the Outside Man Sees the Home Office

HOW does the outside man view the home office? Here's a pretty fair view from R. V. Donaldson, London representative of the Canadian Fairbanks-Morse Co.:

It seems to me that a great deal of misunderstanding occurs owing to the fact that salesmen are inclined to feel that the inside organization does not give sufficient attention to each order he sends in and forgets that the inside staff have a duty to perform to a large number of salesmen, and that it is impossible for those on the inside to devote all their time to one particular order, but the best possible service must be rendered to all.

On the other hand, those on the inside sometimes seem to think that a salesman is just a fellow who travels around the country in a first-class train or drives a flivver around, picking up orders here and there, living on the fat of the land, and getting well paid for it. Needless to say both viewpoints are wrong.

There are many people who have a responsibility in connection with the execution of every order. In this responsibility there are no exceptions, from the manager to the office boy, each must assume his share and must never forget that a moment's carelessness may cost the company a good account.

A curt answer on the telephone, a little sarcasm in a letter, a wire overlooked, or worst of all, a promise of shipment made and broken; a hundred and one little things which seem of no consequence, but which at a critical moment may prove vital to the customer.

Service is the keynote of business to-day. The quality of service given by us to our customers will determine the volume of our business in the years to come. If we are prepared to give our customer the right article to serve his needs in the most efficient manner, and to see that we not only make the sale but also that the article leaves our warehouse in good condition at the earliest possible moment, and be prepared, if necessary, to follow the shipment up and see that no unnecessary delay occurs in its reaching the proper destination, then we can, to a great extent, forget price. I do not mean by this that we can soak a man, but that we can secure business at a price showing us a reasonable profit, and competitors can cut prices if they like, but in the long run we are going to get the business.

Remember the Customer Always

THE point I am trying to impress on the minds of the inside staff is that no salesman can continue to do business unless he has the support and co-operation of the entire inside organization. Every man has got to do his share in the most efficient manner possible, and the only suggestion I have to offer is that the department managers and their assistants endeavor to keep in closer touch with the shipment of orders after the salesman has sent them in. For instance, a big concern gives an order for an article which, unfortunately, is not in stock. This party happens to be a good customer of ours, and the department head or assistant immediately endeavors to pick up the article. Failing to find it in the city, he may wire the factory and have the goods shipped by express. In doing these things he is using all the means in his power to serve the customer, but meantime Mr. Black, superintendent or engineer of the concern requiring the goods, only knows that he gave a salesman the order, and that his work is tied up, and the goods should have arrived three days ago if those fellows in Toronto were on the job. Result—he gets Mr. Salesman, and gives him a dressing down. Mr. Salesman calls Toronto on the long distance telephone, and learns the facts and communicates them to his customer. Mr. Blank says: "All right, but why in 'Sam Hill' did not they let me know that? I would have borrowed a tool from someone else, or done some other work, but now I have lost three, four or five days, as the case may be, waiting on every express to bring the goods." Result—Mr. Salesman spends an hour smoothing up the rough spot. He is generally unreasonable if a delay hits his pocket, or inconvenienced him, and Mr. Salesman has spent an hour's time, and a whole bunch of energy which could have been used in procuring more business, and don't forget, he also spent 60 or 70 cents on a long distance phone call, and used up some of the phone operator's time, the department's time, and the time of the purchasing department.

Advise About Any Delays

NOW, if those on the inside made a practice, in a case of this nature of dropping Mr. Superintendent or manager a little note advising that we had endeavored to get the goods locally, failing which we had been interested enough in giving service to pay for a wire to the factory, and that we were after his shipment, all this soreness and unnecessary friction and expense would have been avoided. Customer would feel better disposed to us, the salesman's temper would have been unruffled, and considerable energy saved to be used in productive effort, instead of reselling the company all over again.

This is the most vital thing I can think of in connection with our "Inside organization," the keeping of the customer advised without his asking for information, as he generally allows the delay to run along until he is good and sore before asking, and then time and money must be spent to remove the sore spot, whereas if we had forestalled his soreness by assuring him we were after his interests he would have felt better disposed towards us.

Selling in a Broad Way

IT seems to me that those on the inside sometimes lose sight of the fact that a salesman does not only sell the article to the customer; that kind of business may be all right, in dealing with a specialty which a man buys about once in his lifetime, but the man who represents us has got to sell himself, his article and also the class of service which the company stands for, because we want, not only the order to-day but the account during the years to come. The time I feel best is when weeks or months after I call on a customer, and open an account, to receive from this office a salesman's copy of a shipping ticket, covering some different line of goods to that which was first sold. Then I know that not only did I sell him one order, but that the manner in which the inside organization handled that order sold him the service of the company, and that I have another solid customer in my territory; and the next time I go back and send my name in to that man he immediately begins to think, "Now, what do we need that I can buy from this man?"

A special dispatch from Rome to the Chicago "Tribune" states that negotiations are being concluded between a representative of a French syndicate and the Italian Government for the construction of a tunnel through Mount Blanc, which will be one of the greatest projects to pass through the Alps. Studies for the project have been going on for about fifteen years. It is now proposed to build an electric railway from Chamonix in Savoy to Amsta in the province of Turin, a length of 50 miles, whereof 10 will be under Mount Blanc. The new railway will join two of the most celebrated valleys with magnificent scenery and perhaps the most renowned among all picturesque cities of the Alps.

NOW that they are going to have an examination for graded certificates for engineers in Ontario power plants, how about an examination for the men appointed to do the examining? Is there any good reason why they should not demonstrate their ability before some disinterested, yet capable, body?

Darling in Des Moines "Register."

The innocent little game of crack the whip.

The Status of the World's Mercantile Fleet

by

T. H. Fenner

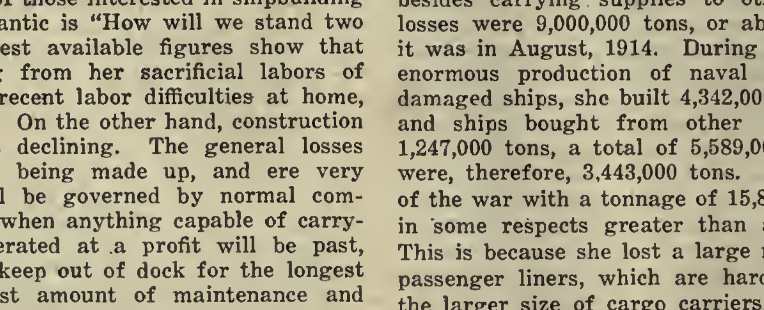
Editor "Marine Engineering"

WITH more tonnage under construction than at any previous time, the centre of gravity of the world's merchant fleets shows a considerable movement from pre-war days. The chief cause of this is, of course, the heavy losses sustained by Great Britain, and the heavy gains made in the United States. Other nations have also come into the field, but the distribution of tonnage between the two great Anglo-Saxon nations is the dominating feature of the situation.

If we look at the relative positions at the outbreak of war, and that of the present day, we will see what a radical change has taken place. The question that is uppermost in the minds of those interested in shipbuilding on both sides of the Atlantic is "How will we stand two years hence?" The latest available figures show that Great Britain, emerging from her sacrificial labors of the war, and her more recent labor difficulties at home, is beginning to catch up. On the other hand, construction in the United States is declining. The general losses in the world's fleet are being made up, and ere very long ocean freights will be governed by normal competitive rules. The day when anything capable of carrying a cargo can be operated at a profit will be past, and the vessel that can keep out of dock for the longest time, and take the least amount of maintenance and operating cost will be the survivor. Again, if two competing vessels are on an equality as regards these prime essentials, the prize will go to that one which enjoys the greatest skill in management. In that day years of successful experience in ship operation will be a big factor against competition from comparative newcomers, however brilliant they may be. But those days are yet in the future, and in the lap of the gods. Let us turn to concrete facts and see where the nations stand.

The Tonnage in 1914

IN August, 1914, the tonnage of the world's fleet was approximately 40,000,000 tons gross. This is equal to about 60,000,000 tons deadweight carrying capacity. Of this, Great Britain possessed approximately 20,000,000 tons, or about one-half the total tonnage of the world. The United States at the same date had 2,700,000 gross tons of ocean-going shipping. France possessed 2,325,000 gross tons, Italy about 1,700,000, Japan about the same, Swden, 1,222,000; Norway, 2,500,000; Denmark, 737,500. Spain had 864,395 tons, Greece about the same, Holland, 1,500,000; Belgium, 400,000, and Brazil, 3,000,000 gross tons. Of the enemy nations' fleets, Germany owned by far the largest. Her fleet was ,in fact, second only to that of Great Britain. She had a total of 5,291,000 gross tons, while Austria had only 1,000,000.



A MODERN OIL TANKER—ISHERWOOD CONSTRUCTION.

During the war the losses to the allied and neutral nations amounted to about 15,000,000 tons. Here, again, Great Britain was by far the largest loser. This was, of course, inevitable. Her ships kept the seas and carried her troops and supplies from every corner of the world, besides carrying supplies to other nations. Her total losses were 9,000,000 tons, or about 45% of her fleet as it was in August, 1914. During the war, in spite of her enormous production of naval vessels, and repairs to damaged ships, she built 4,342,000 tons. Captured vessels and ships bought from other countries amounted to 1,247,000 tons, a total of 5,589,000 tons. Her net losses were, therefore, 3,443,000 tons. This left her at the end of the war with a tonnage of 15,814,000. Her losses were in some respects greater than appears on the surface. This is because she lost a large number of her first-class passenger liners, which are hard to replace, as well as the larger size of cargo carriers, which carried on trade as regular liners on established routes. Now she is getting down to cases, and her yards are busy on the production of both cargo and passenger ships, the naval construction having been dropped. The comparative construction figures further on in this article will show just what is being done in this direction.

The Position of United States

THE record of the United States shipping during the war is, of course, one of pure gain. By new construction alone she added to her fleet 875 vessels of 2,941,845 tons. In addition to this she purchased 233 vessels of 833,854 gross tons, and brought down from the lakes 66 steamers of 140,000 gross tons. Her losses by enemy action amounted to only 322,214 gross tons, and this was offset by the seizure of 81 enemy steamers of 546,000 tons. The U. S. shipping profit and loss account shows a good credit balance through the war. Her sea-going merchant marine of 2,706,317 gross tons in 1914 had grown at the end of the war to 5,515,180 gross tons. Including lake and coastwise shipping, she has 12,000,000 tons.

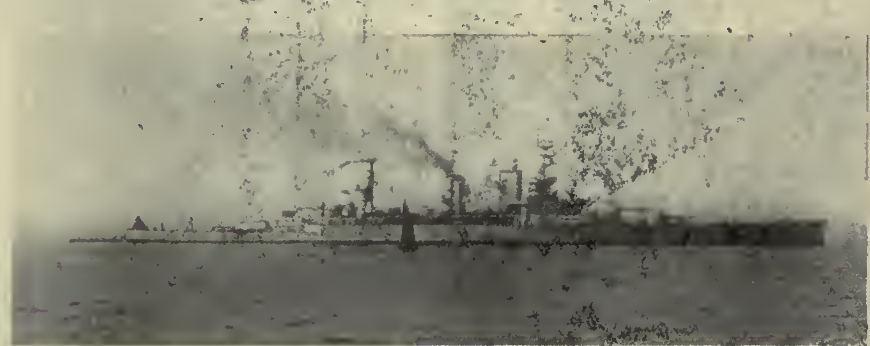
France lost about 40% of her pre-war shipping and has no new construction in her own country to take its place. She is getting some ships built in Canada at present, and a large number of wooden steamers were built here during the war. These vessels were of 1,500 to 3,500 tons deadweight, and their value to France is, with all due deference, problematical. France demanded that the enemy merchant ships seized at surrender should be turned over to her in the proportion of ton for ton, and that she be allowed to buy 1,000,000 tons each from Great Britain and the United States. These plans have not yet been realized, but it shows her ambition to become a maritime nation. This ambition is shared by others.

Italy, who lost about 51% of her merchant fleet during the war, is also taking steps to rehabilitate herself, and a bit more. She has now about 36 shipyards in operation, and still more are planned. She hopes to obtain an annual output of 400,000 tons, if she can obtain the raw material. This has in the past been obtained chiefly from Great Britain, and during the war that source was, of course, shut off. She is looking now to develop her own resources, chiefly on the island of Elba.

Japan was another nation that came out of the war exceedingly well as far as her ships and shipbuilding capacity are concerned. She lost through enemy action only 132,000 gross tons. She sold to other countries about another 125,000 and purchased 130,000 tons. During the war she built for herself 768,325 gross tons, the net result of her activities being an increase of 25% on her pre-war fleet. She also built for the U.S. about 130,000 tons, and had under construction at the end of the war about thirty more steamers for the U.S. Japan has expanded her shipbuilding facilities enormously, and has now an annual capacity of over 1,000,000 tons. However, despite the low cost of labor, the difficulties of securing plates, etc., has resulted in Japanese costs going up till they are in the neighborhood of $185 per ton.

The Scandinavian nations also suffered during the war, and their efforts at new construction were hampered by the lack of raw materials. Norway was the heaviest neutral sufferer among the nations. Out of a tonnage of roughly 2,500,000 she lost no less than 1,178,000 gross tons. To counteract this, she had under construction at the end of 1918 about 200,000 tons. This was made up of steamers and motorships, fifty of which were of wooden construction and eight of concrete. It is interesting to note that the Norwegians were among the first to undertake the construction of concrete vessels, and they adopted methods which have been widely copied by other builders. Sweden lost about 18% of her merchant fleet by enemy action, amounting to 202,000 tons. She had under construction at the end of last year about 60,000 tons. The Swedish yards are very busy, but have suffered from the difficulty of obtaining ship plate, which were in pre-war days imported from England. Denmark also suffered from the submarine activities, her losses being 219,000 gross tons out of 739,532, leaving her in June, 1918, with 600,000 tons. The difference was made up by new construction which amounted to 100,000 tons, and sale to and purchase from other nations about equalized themselves. Spain had a merchant navy, of approximately 864,000 tons before the war. She came out of it with about 650,000 tons. She lost by enemy action 166,000 tons, while marine risks and sales accounted for 133,000 tons. New construction amounted to 35,000 tons and purchases 47,000 tons. Greece, Holland, Belgium and Brazil all suffered heavy losses, the totals being 662,000 tons out of a tonnage of 2,900,000 tons belonging to the four nations.

H.M.S. "WITHERINGTON," 28,000 H.P. GEARED TURBINE.



H.M.S. "RENOWN," 100,000 H.P. GEARED TURBINES.

What Canada is Doing

THE total tonnage under construction in the Dominion of Canada in June, 1914, was 14,184 tons gross. In 1915 the necessity for more ships had become apparent and the Imperial Munitions Board took up the question of building ships in Canada. Contracts were given out amounting to $70,000,000, including both steel and wooden ships. There were 43 steel and 58 wooden ships. This started shipbuilding in Canada in good earnest, and it has kept up so far in very good shape. At the end of 1918 there were 45 berths for steel vessels ranging from 3,500 to 10,500 tons in the various yards. The Canadian Government Merchant Marine programme came along when the I.M.B. ships were being finished, and is still keeping the majority of the yards going.

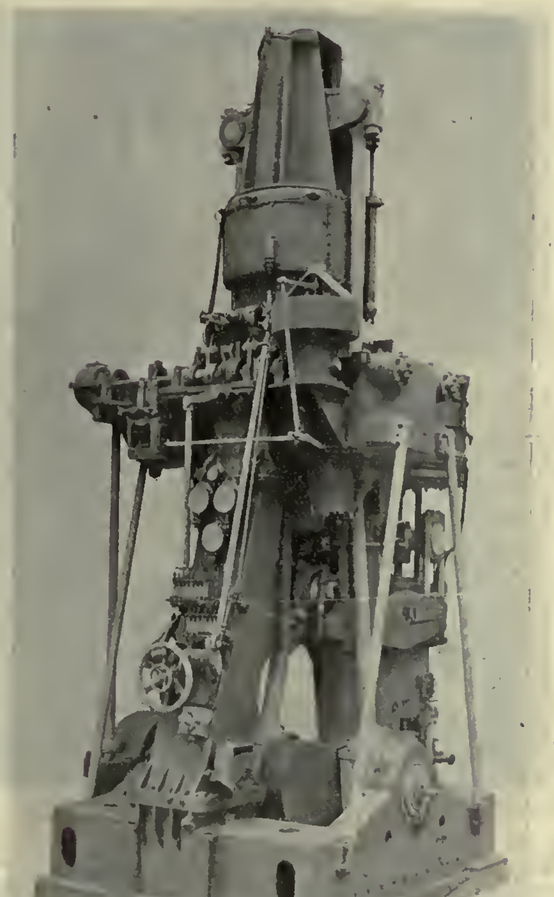
In addition to this, some firms built ships to their own account, for sale, and at least one firm is doing so at present. Other yards have contracts for European owners, and there are at present negotiations being carried on for the securing of a large order from France. This would cover contracts for over 100 ships. It is supposed that the Canadian Government would finance the building of these vessels, the stumbling block at present being the low French exchange rate. The growth of the Canadian shipbuilding business can be seen by a comparison of the tonnage under construction in 1914 with that in the present year. The figures for June, 1914, as already stated, were 14,184 tons gross, while those at September, 1919, were 210,800 tons gross. This was divided as follows: Great Lakes shipbuilding yards had 23 vessels of 53,833 gross tons under way, while on the Atlantic and Pacific coast 29 vessels, of 108,020 gross tons, were being built. The great preponderance of tonnage compared with the slight difference in numbers building, is accounted for by the larger size of the vessels built in the deep-water yards. These vessels are all steel. Besides these, 49 wooden ships of approximately 49,000 tons were under construction. All the other British Dominions had between them only 24 steel vessels of 77,000 tons, and 9 wooden vessels of 6,443 tons.

The cost of building a ship in Canada is now but little different from the English prices. Taking into consideration the fact that English yards are not in a position to take outside orders for some time, and that European nations are clamoring for ships, there should be lots of business for Canadian shipyards. The exchange rate is, of course, a very adverse factor, but this could probably be overcome. Canada's deep-water yards can construct any type of cargo ship, and there are at present oil tank vessels being built on the St. Lawrence. The Canadian Government Merchant Marine have had 24 ships delivered this year, and the remainder, comprising 30 vessels, will be delivered during 1920. These ships are being built at fourteen different yards, situated on the Atlantic coast, River St. Lawrence, Great Lakes, and Pacific coast. They range in size from 3,500 tons deadweight to 10,500 tons deadweight, and will make a very useful fleet when completed. Already a goodly number of them are sailing the seas, bearing Canadian goods to different countries, and bringing their products in return.

AUXILIARY MOTOR SCHOONER.

Another phase of the marine business more particularly connected with upkeep and repair is the establishment of large drydocks of the floating type in Canadian harbors. Sydney and St. John on the Atlantic coast, and Victoria and Vancouver on the Pacific coast, will all have these docks in the near future. An adequate drydock, of the floating or permanent type, is a source of income to the vicinity it is situated in, as well as a splendid investment to the owners. It is also of indirect benefit to the shipowner in that its presence in certain localities exerts a favorable influence on insurance rates. These drydocks should bring many millions of dollars to Canadian pockets that formerly went to our Southern neighbors. Canada has built a large number of motor and auxiliary craft in the last few years, but no Canadian firm has yet tackled the making of the marine oil engine. However, that may come before very long, and be attended with as much success as the building of the marine steam engine.

The great expansion in shipbuilding called for a large number of auxiliary appliances for ship use, and Canadian firms went into this business with as much energy as they displayed in the main effort. The manufacture of steam winches, windlasses, steering gears, pumps, etc., has been so successful that in some cases these machines have been sold to U.S. purchasers in direct competition with American builders.



OPPOSED PISTON TWO-CYCLE OIL ENGINE.

In far-away Australia 12,000 miles from the heart of the Empire, the shipping shortage was felt acutely. There were thousands of bushels of wheat waiting for shipment, a lot of which was spoiled. It was piled along the wharves in many cases under temporary covering. Faced with the knowledge that ships could not be obtained, the Commonwealth Government resolved to build for themselves. They, therefore, gave contracts to several firms in the Commonwealth for twin-screw cargo steamers built on the Isherwood system. The first to be completed was the "Dromana," and eight more are under construction. Since laying down these ships the Government have decided on a programme of fifteen more to be built during the next two years. They have also ordered six 12,000-ton steamers in Great Britain.

The Losses of Germany

OF Germany's fleet of 2,159 vessels, aggregating 5,291,000 tons, which she owned at the beginning of the war, but little remains. At the time of the armistice probably 2,500,000 tons remained in her lands, and a considerable amount of this has been transferred to Allied nations. The actual tonnage remaining to her is not very clear. She built during the war about 740,000 tons. The ships so far divided among the Allies include the cream of her passenger fleets, which cost so much time and money to create. It is only poetic justice that the nation which started out to wipe all other flags from the seas should only succeed in nearly eliminating her own. There will be few tears of sympathy shed over the spectacle.

The quarterly returns issued by Lloyd's Register of Shipping make interesting reading, and the latest available statement is up to September 30th of this year.

There was on March 31st of this year a total tonnage under construction of 7,796,266 tons gross. This only includes vessels of 100 tons and over. Of this total the United Kingdom was building 2,254,845 tons, and the United States 4,185,523 tons. Canada had at this date 61 steel vessels of 168,935 tons, and 42 wooden vessels of 49,452 tons on the ways. The total of the other British Dominions was ten steel vessels, 46,866 tons gross, and 18 wooden ships of 16,987 tons. The remainder were divided over the European nations. These figures relate only to steam and motor vessels. There were in addition 165 wooden and 3 steel sailing vessels being built in various parts of the world, but their total tonnage was only 151,500.

On June 30th there were under construction 1,744 vessels of all types, the tonnage being 5,493,717. These included 1,155 steam and motor vessels of steel, 356 wooden steam and motor vessels, 5 steel sailing vessels and 228 wooden sailing vessels. Great Britain had in hand, 2,524,050 gross tons, the United States at the same time having 3,874,143. This shows an increase for Great Britain of 269,155 tons, and a decrease for the United States of 311,380 tons. Canada had under construction 55 steam and motor vessels of steel, totalling 163,493 tons, and 70 wooden vessels of 81,000 tons, 244,493 tons altogether. The other British Dominions were building 26 steel vessels of 70,256 tons and 13 wooden vessels of 11,647 tons. European nations accounted for the rest.

The British Show Gains

THE latest figures show the position at September 30th, and are interesting as showing the relative activities of Great Britain and the United States. The total for the United Kingdom is 781 vessels of 2,816,773 tons, while that of the United States is only 3,470,748. The increase in Great Britain over the previous quarter is 293,000 tons, and the decrease in the United States about 400,000 tons. Canada had 52 steel vessels of 161,853 tons and 49 wooden vessels of 48,950 tons. This is a slight decrease from the previous quarter, and shows that ships are being delivered with no new orders taking their place. The other Dominions have 33 vessels altogether, 24 steel and nine wood, but the tonnage is about the same as the last quarter.

That Great Britain is getting her large cargo liners back on the seas is evident from the size of the ships under construction. There are 157 vessels of 6,000 tons and over on the stocks, and 18 of these are between 15,000 and 25,000 tons. It is confidently predicted that the output for the full year will amount to 3,000,000 tons. The United States may be going to capture the seagoing trade of the world, but they will know they have been in a race. There are no figures available for Germany or Austria as yet. Holland, Italy and Japan are the only other nations with over 200,000 tons under construction, beside Canada. France has about 180,000 tons.

The ferro-concrete vessel has practically gone out of existence, the only vessels of this type under construction being barges of small size. Wooden shipbuilding is also being relegated to the limbo of forgotten things, as far as large-sized ships are concerned. Both wooden and concrete ships are practically possible as far as being ships is concerned, but they have the fatal drawback of costing as much as a steel ship, with less deadweight capacity. This is a point that cannot be got around, and effectually disposes of their claims to recognition.

New Features of Ship Design

IF the concrete ship, which was to revolutionize all future marine construction, according to the enthusiasts, has slid quietly into oblivion, there have been other developments which are more permanent. Another feature of war-time shipbuilding which was introduced with a great flourish of trumpets, was the standard fabricated ship. This was particularly in evidence in the United States, where it was entered into on a large scale. Briefly, the idea was to introduce repetition production into the science of shipbuilding, and turn it into manufacture. A standard design of ship was decided on, and the making of the scantlings was given out to different contractors all over the country. These firms would cut, bend, and drill the various members to the drawings or templates furnished, and the manufactured shape would be shipped to any yard to be assembled. In Great Britain a number of vessels were built under this plan, but on the conclusion of the armistice, those not completed were sold to private owners in their uncompleted state. These private owners made the necessary alterations to fit them for the particular trade they were going in. Fabricated shipbuilding, as far as the United Kingdom is concerned, has been abandoned. In the States the experiment did not work out with the complete success expected, but there are a considerable number of these ships still under construction.

The greatest departure from old established practice was the introduction of the Isherwood system of construction. From time immemorial boat builders have built their craft with vertical rigs or frames attached to a longitudinal keel. These frames are spaced from 2' 6" to 4' apart, according to the size of vessel, and the shell plating is riveted on to the skeleton thus formed.

The Isherwood system, so named after its originator, departed completely from this practice. The main scantlings of the vessel are laid fore and aft, or longitudinally, the vertical framing consisting of deep frames at considerable distances apart. This method allows for greater strength with considerably less weight of steel. It is being adopted more and more every day, and especially in the construction of oil tank vessels.

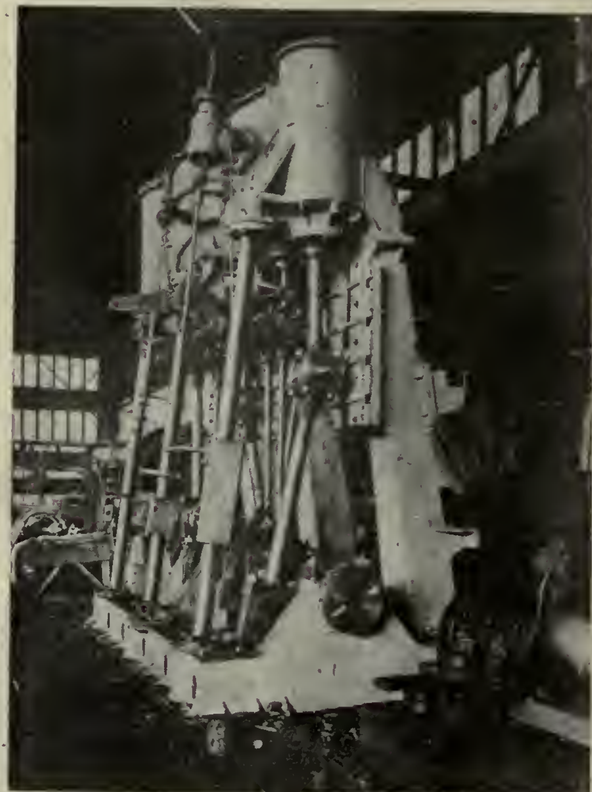
Electric welding, while for many years employed in the repairing of vessels, has only since the war been suggested as a means of construction. A vessel of 150 feet in length has been laid down, in the construction of which riveting will be entirely eliminated. She may be completed by the time this article will appear, and her performance will be watched with interest. Lloyd's Register Committee have also approved a design for a vessel on the Isherwood system, in which the plates will be attached to the longitudinal framing by this method.

Development in Marine Engines

WHEN we turn to the propelling end of marine design, the great advances made are apparent. After long years of successful and reliable operation, the triple and compound inverted vertical reciprocating engine seems doomed to pass away, and its place taken by the geared turbine and internal combustion engine.

From the inception of steam navigation on the ocean, development was comparatively slow. The first great revolution was the introduction of the screw propeller to take the place of the paddle wheel. Following this came the introduction of the compound expansion engine, the first trans-Atlantic steamer to be fitted with this type being the "Holland" in 1870. From the two stage expansion developed the three and four stage, and it was felt that the last word had been said in this direction. From 1881 to 1896 the only improvement made was in the direction of higher pressures, and slight gains in economy. Then in 1896 the engineering world was startled by the advent of the "Turbinia," a little vessel of 45 tons displacement, 100 feet long, 45 feet beam, which tore through the water at the speed of 34 knots an hour. This was achieved by the use of Sir Charles Parson's turbine. The British Admiralty immediately started experimenting with the new motor with the result that about 1905 this method was finally adopted for all the vessels of H.M. Navy.

The turbine was introduced into the merchant service in 1907, by the "King Edward," a Clyde pleasure boat. The



TRIPLE EXPANSION RECIPROCATING ENGINE.

Allan Line steamer "Victorian" was the first trans-Atlantic steamer to adopt it in 1905, and then came the two sister queens of the seas, the "Lusitania" and "Mauretania." Thus was the turbine definitely placed in supremacy for all high speed, high-class liners. The great bulk of the merchant marine still held fast to the reciprocating engine, the reason being that for speeds under fifteen knots the turbine was not efficient. This was because of the high speed, of rotation necessary for efficiency, which was only practicable on high speed ships. However, ingenuity in the engineering world was not to be stopped by this obstacle, and in 1910 the "Vespasian" was fitted with a reducing gear between the turbine and propeller, which allowed both to be run at their most efficient speed. The single reduction gear was so successful that it was developed further, and a double reduction gear introduced. The success of this may be estimated by the fact that in June, 1917, Lloyd's classed 23 vessels of 153,000 tons fitted with either single or double reduction turbines, and in the following twelve months 72 vessels of 367,960 tons, while in the year ending June 30, 1919, they classed 183 vessels of over 1,000,000 tons. The largest of these vessels was the oil carrier "San Florentino" of 12,842 tons. This does not take into account war vessels, of which the "Renown" is an outstanding example.

Another development has been the combination of steam turbines direct connected to electric generators, which drive motors connected to the propeller shaft. The best example of this style of equipment is the U.S. battleship "New Mexico," while in England the "Wulsty Castle," a vessel of 3,566 tons, has been so fitted.

The adoption of the internal combustion engine for sea-going vessels dates from 1910. In this year the "Vulcanus," of 1,179 tons, was fitted with a Diesel engine of six cylinders, 15¾ inches diameter by 23⅝ inches stroke. The development in this type of engine may be seen by the fact that the latest and largest vessel of this type is the "Glenapp," fitted with two sets of engines driving twin screws. Each set consists of eight cylinders 29½ inches diameter by 43 5-16 inches stroke, the horse-power of the two being 6,400. The "Glenapp" is 7,374 tons gross, about 11,000 tons deadweight.

The Engine of the Future

It will be seen by the foregoing that there are rivals a-plenty for our old friend the triple expansion engine. Which of them will eventually gain the palm, and occupy the position so long and honorably held by it in the marine world? To answer that we must look into the question a little deeper than we have up to the present.

In deciding on the type of power plant to be adopted in a ship, several factors must be considered, all of which have an important bearing on the final decision.

The most important is reliability, or freedom from danger of breakdown. The great bulk of the world's trading is carried on by ships that have to be away from their home ports for months at a time, sometimes even years. It is absolutely necessary that the motive power must be capable of long sustained running with only minor adjustments. A major repair carried out in a foreign port may easily devour the profits of several voyages.

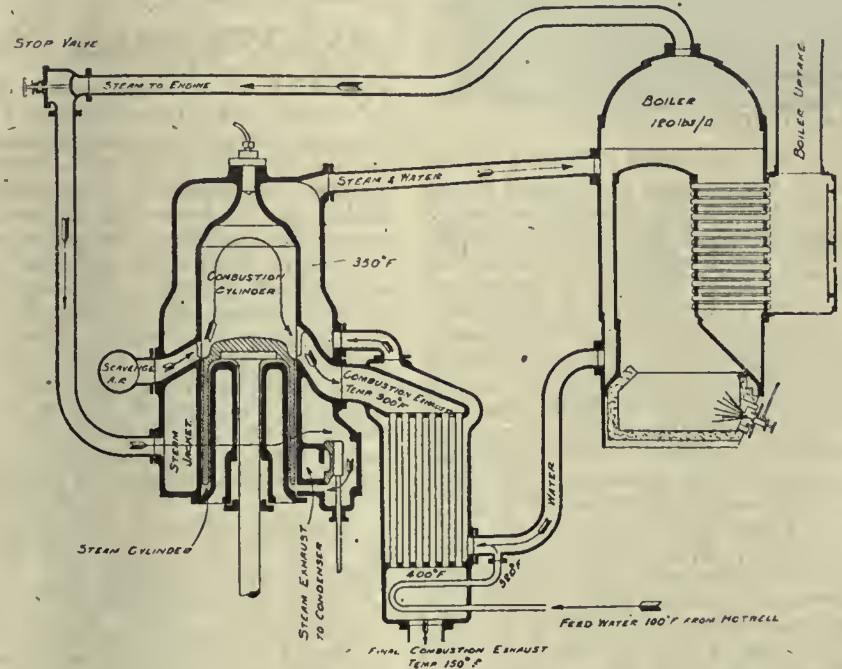
The second consideration is weight and space occupied. These must be a minimum as every cubic foot occupied by the power plant, and every ton displacement, is obtained by sacrifice of earning, or cargo carrying space.

Fuel economy comes next. Not only in the actual fuel used per horse power is economy beneficial, but greater economy in fuel consumption means less fuel carried for a certain length of voyage. This enables more cargo to be carried. If the voyage is a long one, it means less calls for replenishing fuel stores, saving money in pilot and harbor dues. It also enables the fuelling to be done where that commodity is cheapest, or at least leaves some alternatives.

Maintenance and operating costs come next. The prime mover which requires the minimum of attendance, and consumes the least supplies, may be more desirable than one which is cheaper in first cost, or slightly more economical in coal.

Regarding the question of reliability, there is nothing to choose between the reciprocating engine and the geared turbine. The triple expansion engine has moved the world's fleets around the oceans, with a remarkable absence of breakdowns. The only thing that made them a total breakdown was the breaking of a tail end shaft, and these accidents were few in proportion to the number of vessels engaged. In the early days of turbine operation, some trouble was encountered, due to the stripping of blades, but this has long since been eliminated. Turbines with and without reduction gears are now giving as reliable service as the older reciprocating engines.

Taking up the subject of weight, the geared turbine installation has the advantage of the reciprocator. In figuring on the total displacement for each type of engine, the fuel consumption must be taken into account. The installation which uses the least fuel allows for a greater amount of cargo being carried. The consumption of fuel for all purposes with a good triple expansion engine may be taken as 1.6 lbs. per I.H.P. per hour, while that of the geared turbine will be about 1.3 lbs. per S.H.P. per hour. I.H.P. means indicated horse power, while S.H.P. means shaft horse power. The shaft horse power will be in the turbine installation about 96 per cent. of the I.H.P., so



THE STILL OIL AND STEAM ENGINE.

that consumption per I.H.P. will be about 1.2 lbs. This is taking the fuel used to be coal. If steam is generated by oil, the consumption will be less in both cases, but the real factor is that the steam consumption of the turbine is least. The consumption of fuel figured on here includes that necessary for driving the auxiliaries, which must be taken into account. We see, therefore, that the geared turbine is equal in reliability to the reciprocating engine, and is the better as far as weight and fuel consumption are concerned. In first cost the geared turbine installation is from 3 to 4 per cent. dearer than the reciprocator. This disadvantage is more than outweighed by the other advantages.

The turbo-electric drive, while slightly more economical in steam consumption, is much heavier than the geared turbine, and is also higher in first cost. The complicated electrical connections call for much more skilled attendance than is required for the geared turbine, and we may safely say that for the general cargo carrying steamer its adoption is unlikely. For naval vessels it may have a field.

A further combination which has proved very successful in a certain class of vessel is the reciprocating engine exhausting into a low pressure turbine. This is the arrangement adopted in the famous "Olympic," and gives economy of operation with flexibility in manoeuvring. However, it is with the typical cargo carrier of 6,000 to 10,000 tons that we are more immediately concerned. This type is the backbone of the merchant marine.

The Oil Engine's Future

WE will now consider the latest type of marine engine, and the one which many people believe will be the standard type in a few years. The internal combustion engine has a good many points in its favor with but few against it, and the latter are gradually being eliminated.

In the first place, the use of the internal combustion engine eliminates at once, boilers, coal and boiler room crew. Instead of large spaces being occupied to store coal, the oil is carried in the ballast tanks. This, of course, is true of an installation using oil fired boilers, but the difference is that the internal combustion engine uses only about one-half the fuel consumed by the most economical steam motors. In a steam engine the heat losses start at the furnace, and go on to the condensor. The result is that in a reciprocating engine the overall efficiency is about 12 per cent. In a turbine it is about 16 per cent., while in the oil engine it is about 30 per cent. The thermal efficiency of the oil engine is higher by far than any steam engine or turbine can ever reach.

The first cost of an oil engine is probably 20 per cent. higher than the geared turbine type, but the crew necessary is only about two-thirds that of the latter. This coupled with the much lower fuel consumption places it far ahead as an economic factor. While the saving of weight in the engine itself is not great compared to the turbine installation, the increased cruising radius, or the smaller quantity of reserve fuel required, is much more important than the actual engine weight.

It has had several disadvantages to fight against. The first, and one of the greatest, is the limitation of power that could be developed in each cylinder. This limitation precludes its use in very high-powered vessels. About 500 H.P. per cylinder would seem to be the limit at present, but a further adoption of the two-cycle type may increase this considerably. Difficulty of reserving and starting were also a drawback, but these may be said not to figure in the latest types. Difficulty of finding oil stations militated against both oil fuel and the oil engine for some years, but is practically overcome now. The great drawback seems to have been the liability to irreparable breakdown and the difficulty of finding highly trained attendance. With improvement in design, and greater experience the first difficulty should gradually vanish. With the more general adoption of this engine the men will be trained. British engine builders are developing their own designs, and improvements are taking place frequently. One of the most promising of these is the Still engine, in which the exhaust gases are utilized to evaporate the water in the cylinder jacket, the resulting steam being used on the opposite side of the piston. By this method a still greater efficiency reaching as high as 40 per cent. has been obtained. The development of the two-cycle opposed piston type will result in reducing the weight per horse power, allowing of larger units, and decreasing the number of cylinders required for a given power. Taking it all round, the oil engine promises a reduction in weight, space, attendance, and fuel, a combination which should result in its general adoption for all medium speed cargo vessels of 6,000 to 10,000 tons.

The first-class express steamer and the warship will no doubt be propelled by the geared turbine for some time to come, while the mixed cargo and passenger liner of 17 to 20 knote will no doubt use the combined reciprocating and turbine installation in many cases. With the growing need of economy in both coal and oil, and the steady increase in wages, marine engineers must keep on their investigations to determine the most efficient motor. Special trades require specialized treatment, but the outlook for the internal combustion engine is good. Some day the practicable internal combustion turbine will be discovered, marking another great stride in the science of marine propulsion.

The Outlook in Canada

CANADA has a large number of well-equipped y… to-day, with efficient managing and operating staffs. There are between the actual building and the contributory trades probably 40,000 men employed. The pay roll amounts to something like $40,000,000 a year. Every British yard is booked up for two years to come. That means that the most dangerous competitor is removed. All Europe wants ships, and must get them built outside of their own countries. The exchange rate operates just as much against the U.S. as it does against Canada, putting them on an equality. Canadian yards can build as well and as cheaply as United States yards. It is up to them to go after the foreign orders and keep their yards going. If they can be kept in successful operation for the next three or four years, they should be in a position to face the future with every confidence. Make shipbuilding a permanent industry of the country.

According to "Der Schweizerische Eisenwarenhandel," a file when new, if viewed under a strong magnifying glass, will be found to consist of fine points or teeth, so far as the cutting surface is concerned, and if passed over a piece of hard steel or other hard resistant metal, it will be found that the majority of these teeth have splintered off, leaving a very indifferent set of cutting points. For this reason, it is best always to use files first on brass and copper alloys, as this saves the teeth from breaking away, while the heat engendered by the working friction somewhat anneals them, and makes them fit to follow on with wrought iron and mild steel, harder steel and cast iron taking the last place, and after these the files want re-cutting, if they be thick enough.

A gas stove is now available for housekeepers that has a heat measuring device for the oven. A thermostat is made use of, which automatically maintains even heat at a constant temperature, and also enables the cook to select at will any pre-determined temperature. The regulator will automatically maintain it for any definite period.

Fitted with flanged steel wheels, a motor truck was recently used to reclaim an abandoned railroad spur line extending to a deserted lumber camp in Montana, thus saving a large amount of money for the company. A small flat car served as a trailer on which were hauled the rails. The truck used was standard make, one-half ton, and in the first month travelled 3,300 miles, or about 108 miles daily.

The Making of Nickel-Chromium Products

By W. F. Sutherland

NOT so very long ago the engineer's handbook contained a few well-known facts regarding the physical properties of the more common industrial metals. Reference information of this character was somewhat limited and the engineer was also handicapped by the paucity of the materials at his command. The handbook of to-day must contain a fund of data relative not only to iron, copper, brass and other well-known alloys, but must also embrace the subject of nonferrous alloys to a much greater extent than has been the practice heretofore.

Metals, which for many years had been of interest only to the scientist and to the laboratory investigator, are now used with signal success in the making of articles of high value in the industrial arts. Chromium is one such metal, and, alloyed with nickel, it forms the basis of many alloys used where high temperature conditions are encountered. Carbonizing boxes, annealing pots, lead pots and similar articles are subjected to the action of external heat, and it is desirable that the materials from which they are made should possess a number of characteristics, such as the power to resist the action of either oxidizing or reducing flames; resistance to the action of metals and salts and toughness under high temperature conditions, even as great as 2,500 degrees F. It is also desirable that the material should be soft enough for machining.

VOLTA FURNACE AND REGULATORS.

Hiram Walker and Sons Metal Products, Ltd., Walkerville, Ont., are the manufacturers of "Nichroloy," an alloy possessing the desirable qualities enumerated above. It is composed of low carbon steel, chromium, silicon, manganese, aluminum and nickel, together with two other metals, forming a very hard and clear surface when cast.

The physical qualities of the alloy closely resemble those of steel even when heated. The metal machines similar to a medium high carbon cast steel, yet, when machined, does not oxidize or rust, but maintains for a considerable time its grey steel appearance. Unlike steel, too, it does not become porous when heated, and when used for carbonizing boxes this property tends to the conservation of the carbonizing compound. The life of the boxes depends, of course, upon their size and thickness, as well as the temperature to which they are subjected. Life runs of about 3,500 hours are common.

The life of nickel content alloys when used for containers of molten metals or salts to some extent depends upon the percentage of nickel. In this alloy the nickel content is low and a scale is formed when heated in the air. By producing the scale artificially in the interior of the pots it is possible to prolong the life very materially.

Manufacture of Nichroloy Products

Naturally enough, when the product has to withstand high temperatures in the performance of its duties, its manufacture involves the use of higher temperatures to secure fusion and in the electric furnace is found the most suitable means of melting. In the present plant a one-ton electric furnace, made by the Volta Manufacturing Co., Welland, is installed. This furnace is of the three-phase type, using six-inch Acheson graphite electrodes and is fitted with a Thury regulator made by the same firm. The usual rheostats and hand control, together with ammeters for indicating the current input, are also installed. Low tension current for furnace operation is supplied by three single-phase Packard transformers, which step down the 13,200 volt, 25 cycle

GROUP OF DRAW BENCHES IN WIRE DRAWING DEPARTMENT.

supply to 100-95 or 90 volts, depending on the tap employed. The high tension is connected star, while the low tension is connected up in delta, the delta being placed at the transformers.

A switchboard forms part of the equipment, two Condit oil switches being mounted, together with a graphic wattmeter and an integrating wattmeter, both of Canadian Westinghouse make. The furnace lining is of magnesite brick for the hearth, with silica brick lining above and a silica brick roof.

In the making of nichroloy, the nickel is charged into the furnace in shot form and the chromium as ferrochrome. No slags are needed for refining as in steel making, the only additional agents needed being ferrosilicon and ferro-manganese. These ferro-alloys serve to eliminate any oxides formed in the metal.

Monel Metal

In the making of alloys which resist corrosion, there is a broad field for a metal which will withstand acids, high temperatures and the erosive action of hot gases and super-heated steam. Monel metal meets these severe requirements, and as the Canadian distributors, Hiram Walker and Sons Metal Products, convert this metal into the form of the finished casting or wire for the Canadian market.

Monel metal is not a synthetic alloy, but is a natural combination of nickel and copper, which is refined without changing the relation of the important elements, i.e., nickel and copper. These two metals bear the same relation to each other when the alloy is refined and fabricated as in the ore taken from the mines. The alloy contains approximately 67 per cent. nickel, 28 per cent. copper and 5 per cent. other metals.

In making castings, the natural alloy, either in shot or ingot form, is charged into the furnace and melted down. Metallic magnesium is added for deoxidation near the end of the heat before the metal is poured.

Moulding Practice

Pouring temperatures encountered are much higher than those prevailing in the iron foundry and accordingly the foundry practice adopted is, to a large extent, that of the steel foundry. Exceptional care is taken to ensure good moulds since the metals cast are of comparatively high intrinsic worth and spoiled castings come high. Dry sand moulds are used, the binder being molasses. A silica wash is also employed when particularly smooth castings are desired. The baking of the moulds is very thoroughly done since moisture detrimental to the proper casting of either nicholoy or monel metal.

Wire Drawing

Nickel-chromium alloys possess valuable properties when used for resistance wire in electrical apparatus. Their specific resistance is high, varying with the different grades; their melting point is high and their immunity from oxidation makes them particularly adapted for use in heating appliances, both industrial and domestic.

This company manufactures "Chromel" resistor alloys in three different classes, each having its own electrical characteristics. Chromel "A" contains approximately 80 per cent. nickel and 20 per cent. chromium. It is especially useful in electrically-heated devices operating at temperatures above 1,600 degrees F. and up to 2,000 degrees F. Its resistance to oxidation and corrosion makes it very useful for electric stoves, furnaces, hot plates, etc., Compared with copper, its electrical resistance is 60 times as great at 75 deg. F. Chromel "B" has a lower chromium content since its composition is approximately 85 per cent. nickel and 15 per cent. chromium. It has a slightly lower electrical resistance, running about 51 times that of copper at 75 deg. F.

Chromel "C" is a nickel-chromium-iron alloy containing about 25 per cent. iron and 11 per cent. chromium. It finds considerable use in sadirons, toasters and other devices of a similar nature.

The Canadian demand for these various types of re-

FINISH DRAWING BY MEANS OF DIAMOND DIES.

sistance wire is met by the product of this factory and in addition to chromel wire, monel metal wire is also drawn. Aside from tungsten the chromel alloy "A" is the hardest wire drawn commercially, and since tungsten wire is drawn for lamp purposes only, the drawing of chromel alloy is no small achievement.

Various factors enter into the successful drawing of the metal. The drawing must proceed at a uniform rate, the wire must be supplied with the proper lubricant and the annealing and cleaning of the wire between operations must be carefully done.

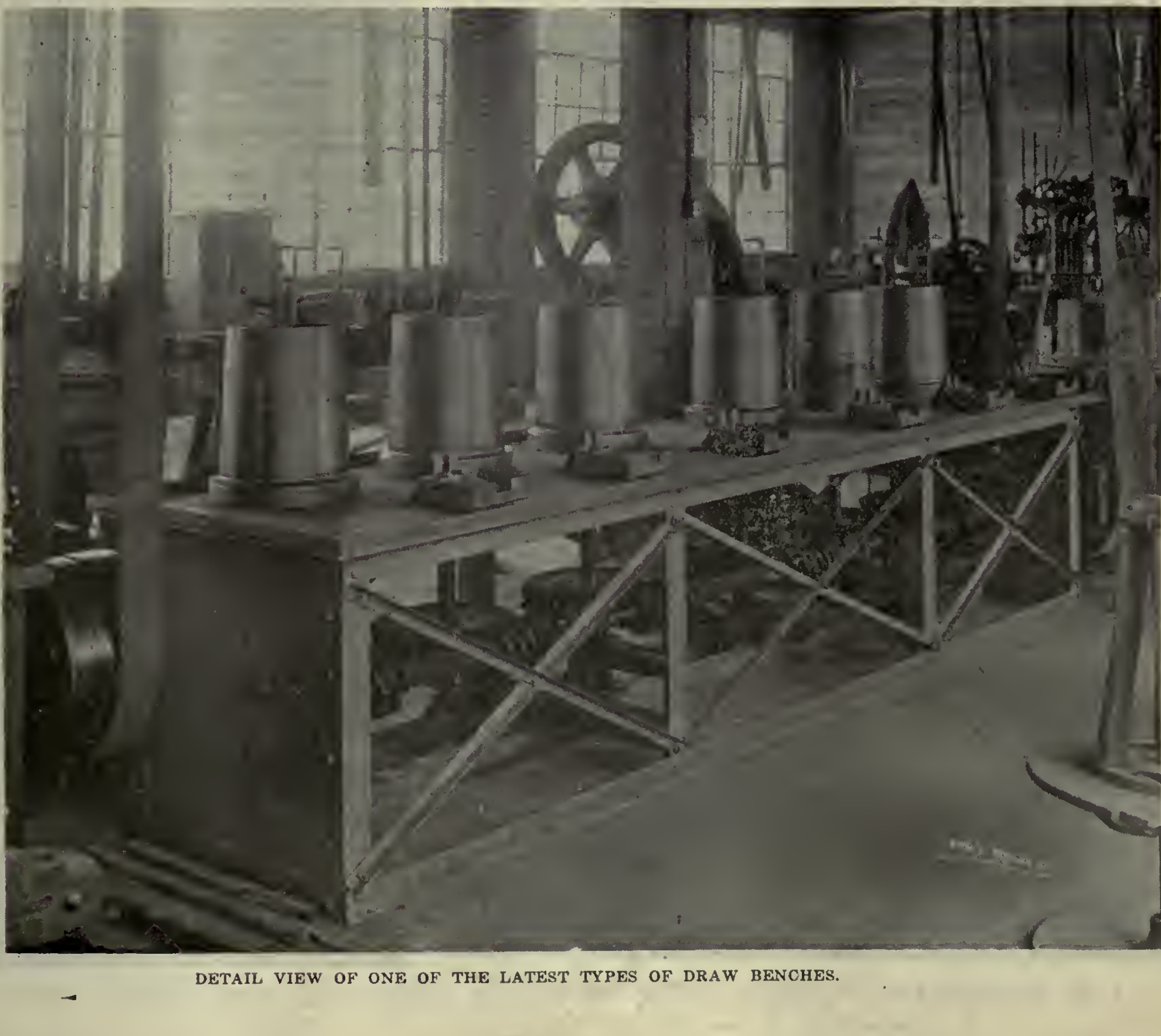
From the accompanying illustrations a good idea of the drawing operation may be gained. A number of draw benches are provided and are fitted with rotating heads upon which the wire is coiled and by means of which it is pulled through the dies. Two kinds of dies are used, chilled cast iron and the diamond. Since the latter is used on a somewhat special machine it will be considered later.

A word as to the mechanical details of the drawing benches: They consist of an angle-iron framework supporting a flat iron top. Through this top each vertical shaft projects and is provided with bearings and a worm gear meshing with a worm on a horizontal shaft running the length of the bench. This shaft is belted to the line shaft in the usual manner and is fitted with a friction clutch, by means of which it may be started or stopped.

Five stands or benches are used in drawing with cast iron dies. The first of these is a single drum machine with a 24 in. drum. The second stand is of similar construction to the first, mounting three drums of the same size. The third stand has six 14 in. drums arranged in two sets of three each. Two more stands of two drums each complete the equipment for using cast iron dies.

The drums on each stand can be used singly or in multiple, that is, the wire being drawn can be taken from the reel, passed through the die and wound upon the drum, or it can be reeled off, passed through the die, given a loop around the drum and through another die to the next drum in line, and so on until it reaches the last one, where it is coiled. By this means it is possible to effect several reductions in the one reeling with considerable economy.

The character of the metal being drawn determines the number of passes advisable; with monel, six are possible, but with chromel, three are about the limit, the greater hardness of the latter metal making the drawing operation more difficult and necessitating more frequent annealing. The wire, of course, elongates in being drawn through the dies, owing to the reduction in diameter, and at first sight it might be supposed that difficulty would be encountered from this source in multiple drawing, since the drums on each bench rotate at the same speed. This fact is of no importance, for the wire looped about the first and intermediate drums slips sufficiently to compensate for its growing length. The dies are of cast iron, chilled, and are cast in rectangular shape with rounded off cone-shaped depressions. The wire hole is drilled to the smallest size and carefully reamed to the correct taper. On being worn oversize the hole is then reamed to the next size larger, and as this is repeated until the opening is worn too large for the largest pass, a considerable life is thus obtained. The multiplicity of



DETAIL VIEW OF ONE OF THE LATEST TYPES OF DRAW BENCHES.

holes in each block also tends towards economical use of the die blocks.

The benches above described are made by the firm for its own use and are of interest in that the worm drive is contrary to usual practice. The extra expense is justified in the securing of more uniform tension in the wire. This is of considerable importance in the drawing of a difficult metal, such as chromel.

Diamond dies are used for the reduction of the wire to the finished sizes for the market. These dies are set in brass holders and the machine shown in one of our illustrations is of much smaller dimensions than those just described. While this is the case, these last machines, of which there are two, are capable of drawing monel wire through ten passes with the one reeling. Six passes are the limit on chromel wire.

Starting from the reel the wire passes through the first die and then over a drum beyond, from which it passes through the bath of lubricant and up over another drum on the original side of the die. From this it passes through the second die and repeats its course until all dies have been passed. From the late die it is wound on a receiving drum. Both horizontal cylinders and the receiving drum are power-driven. The elongation of the wire here as in former drawings is taken care of by slip. The dies are supported by an iron bar through slots in which the wire passes.

The lubricant here used is of a liquid type, a special soap being one of the ingredients. Wire is drawn from 5-16 in. rod down to standard gauges, as required by customers. The smallest size usually drawn is .009 in. in diameter; this corresponds to about No. 31 B. & S. gauge. The draft in each pass varies with the material and with the diameter of the wire; it varies from .025 in. down to about .0005 in. for the smaller sizes. The wire is annealed at various stages of the drawing. The annealing is done in a separate building with two oil-fired pot furnaces and fitted with quenching and pickling tanks. A special coating is also given the wire to assist in the lubricating of the dies used.

After a final annealing the wire is reeled on spools and is then ready for the market.

Making Turbo Blowers and Alternators

A Line Now Being Made in Canada—Many Interesting Features in Connection With This Type of Equipment—Work at Dominion Bridge Company Plant

By C. O. THOMAS, Asst. Chief Engineer of Turbine Dept., Dominion Bridge Co.

THE construction of steam turbines of any considerable size in Canada has not, until recently, been considered a commercial proposition. Yet it seems unreasonable to suupose that this country, which has developed so many different lines of engineering manufacture, should continue longer to stop short at the steam turbine. The principal prime mover of the age is now, however, a product of Canadian industry in the form of steam turbines, manufactured by the Dominion Bridge Company under license from the Rateau-Battu-Smoot Company of New York. Two of these units are each of 2,150 h.p. and drive blowers, also built by former company, for the conversion of nickel material at the plant of the British American Nickel Corporation of Nickelton, near Sudbury, Ont.

The blower unit, illustrated in outline by Figure 1, is a direct connected set, consisting of the turbine and a multi-stage blower, delivering 36,000 cu. ft. of air per minute at a pressure of 12 lbs. sq. inch above atmosphere. The turbine takes superheated steam at a pressure of 180 lbs. and exhausts into a surface condenser at 28 in. vacuum relatively to a 30 in. barometer.

The turbine is of the Rateau impulse type, with characteristically large clearances between the bucket, and stationary parts, and the normal running speed of 3,600 r.p.m., is well below the critical speed of the shaft. Although the end thrust with this type of turbine is almost negligible, a trust bearing of the now well-known Kingsbury type is provided to retain the motor in its proper endwise position. These bearings have given perfect satisfaction on the steam trials. The packing boxes consist of a series of self-centreing carbon rings, the leakage from the first two or three at the high pressure end being led back into the turbine casing where the steam is utilized by the nozzles which receive it. Some of this steam is also conducted to the exhausts end packing box to seal the vacuum against air leakage. High pressure steam can also be supplied for the same purpose when starting up or at very light loads.

An interesting feature of this turbine is the air fan governor. As the pressure of air delivered varies with the speed, this pressure regulates the position of the steam actuated admission valve. Very close regulation is attained. The fan is directly mounted upon the turbine shaft beyond the outer bearing and the air pressure is also used to operate an emergency shut-off valve in the cage. An advantage of the fan governor is its extreme simplicity, no lubrication being required owing to the absence of sleeves, links, etc. The impeller blades of the blower, shown in Fig. 1A, which is connected to the turbine by a flexible coupling, consist of high-grade forging machined all over and have a section tapering to the periphery in such a manner that the stress is nearly uniform along

FIG. 4—GENERAL VIEW OF TURBINE ASSEMBLY DEPARTMENT.

FIG. 3—2100 H.P. TURBO BLOWER ON TEST BLOCK.

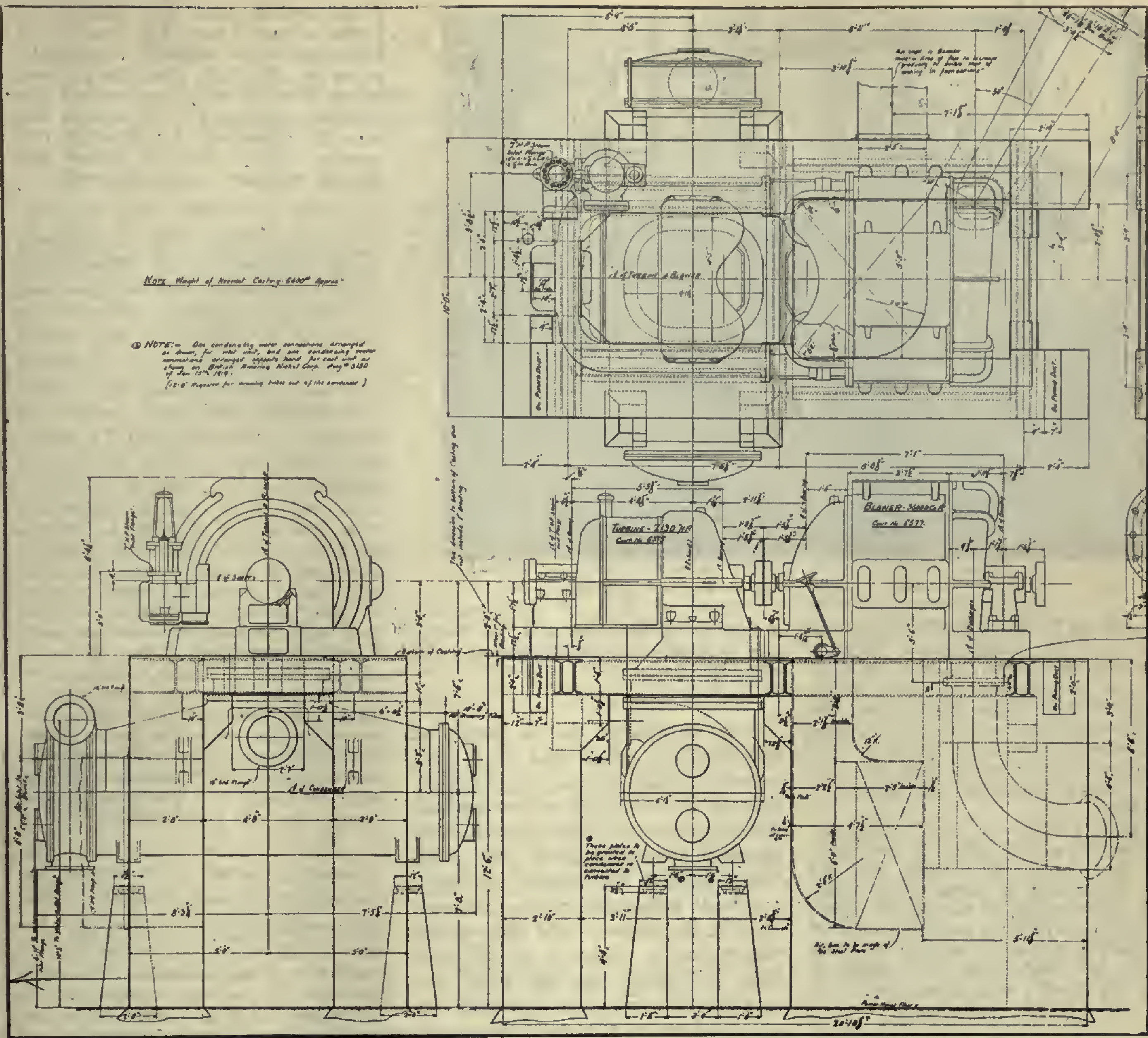


FIG. 1—LAYOUT OF DIRECT CONNECTED TURBINE AND MULTI-STAGE BLOWER.

the entire length of the blade. The blades are secured to the shaft by T heads fitted into corresponding slots milled in the shaft, each blade being machined until the weights of all are equal. This construction results in a very well-balanced and strong rotor with no end thrust, as there are no revolving discs to give rise to it. One of the bearings, however, is provided with an adjustable thrust collar to maintain the axial clearances constant. The blower is cooled by means of water circulation in cored spaces, which can be opened for leaning. Like the turbine, the blower can be readily opened for inspection by lifting the top half of the casing. Oil is supplied from the lubricating system of the engine room, in which there are three other blowers driven by turbines as well as an alternator. The oil is lifted by independently driven pumps to an overhead tank, from which the bearings are supplied by gravity, the oil thence draining to three cooling tanks before returning to the pumps.

A volume pressure curve characteristic of this blower is shown in Figure 2. An automatically operated stabilizer

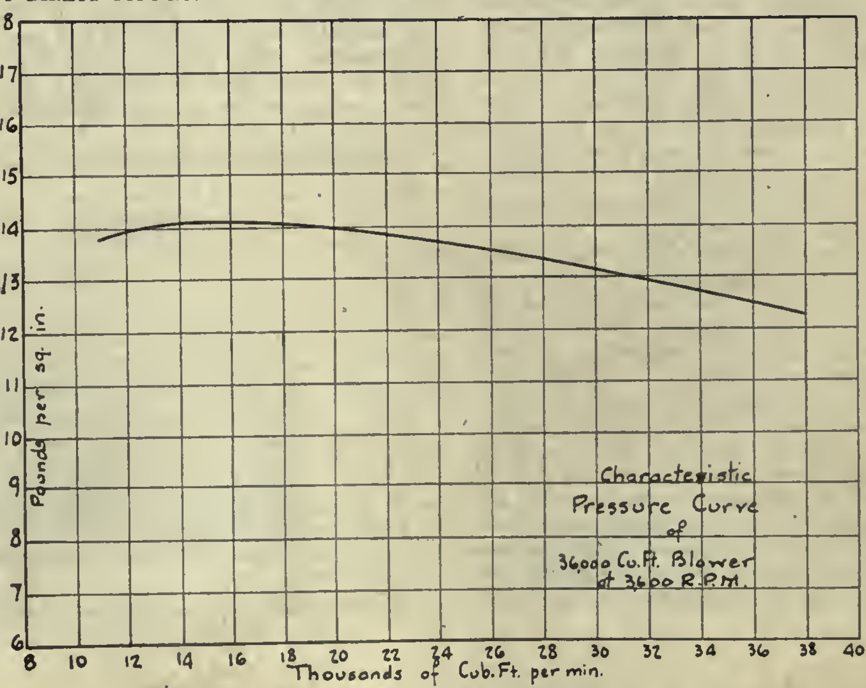


FIG. 2—DIAGRAM OF VOLUME PRESSURE CURVE.

FIG. 3—2100 H.P. TURBO BLOWER ON TEST BLOCK.

valve in the air discharge line, in accordance with the usual practice, prevents any back flow occurring at light loads. On test at the manufacturer's works, the guaranteed steam consumption and output were fully met, the unit running with marked absence of vibration. The machine mounted on the test bed with its surface condenser is shown in figure 3.

Figure 4 is a view of the Dominion Bridge Company's assembly shop with five turbines, three blowers, and two A.C. generators in course of construction. On the right of the picture, paper-making machinery is seen in course of erection. Turbines and blowers in earlier stages of construction are shown in figure 5, where a blower impeller is also to be seen as described above.

In summing up the merits of pulverized coal as a fuel for open-hearth furnaces, Mr. N. C. Harrison, the general superintendent of the Atlantic Steel Company, says that in the case of the pulverized fuel, all the heat units in the coal are consumed in the furnace, while in the case of the gas producer some 18 to 25 per cent. of the heat units are lost in the producer itself when converting the coal into gas. Coal can be pulverized in plants of about 100 tons daily capacity and delivered to the furnace for about 50 cents (2s. 1d.) per ton, which is about the same as the costs for gasifying coal in gas producers. When using the same coal as in gas producers, the flame is hotter, which allows the use of a greater percentage of scrap per ton of steel. On the other hand, however, the refractory costs have been very much greater in the furnace using pulverized coal than in the gas producer furnaces, and were almost twice as great a year or so ago, although Mr. Harrison believes that refractory costs will steadily decrease.

Some information on the system of steaming gas retorts was given at a recent meeting of the Midland Institute of Mining, Civil and Mechanical Engineers by Mr. Riley, the coke-oven manager at Tinsley Park. Mr. Riley explained that the steam connection was made about 18 in. up from the oven level in the centre of the door; a hole was drilled to receive a 1⅛ in. coupling. The steam pipe ran along each side of the oven, with branches at every oven, and the steam was introduced by a flexible hose with a nozzle. When about to start steaming a rod was rammed into the coke and the nozzle inserted, which tapered from 1 in. to ⅜ in. This was inserted and the steam turned on for four or six hours; at the present time they steamed for hours at each end. Of course, the steam had to be turned on very slowly, owing to the fact that the pressure might blow off the roofing and the charging hole caps. The system had been in operation for four or five months, and he had not noticed any damage whatever to the oven walls.

In a paper read before the American Electro-Chemical Society, Chicago, Mr. G. M. Clark states that two American concerns have developed methods of heating rivets electrically. The American Car and Foundry Company employs a method whereby the rivet itself forms a short-circuit connection across the secondary of a transformer. A spring device holds the rivet in the desired position across the ends of the transformer, whilst the operator holds the rivet with a pair of tongs and brings the spring holding device into operation by means of a foot lever. The consumption of electrical energy is about 20 units per 100 lb. of rivets, and the time taken to heat the rivet naturally varies with the size of the rivet. In another type of heater, employed by the Electric Furnace Company, a granulated carbon block forms the short-circuiting device across the transformed secondary, and in turn radiates heat to the rivets. The consumption of electrical energy for this type is about 18 units per 100 lb. of rivets.

According to Mr. F. B. Silsbe, the cracking of the rubber insulation on the high-tension cables connecting the spark plugs of petrol motors to the distributor is due to ozone. The ozone produced by electrical discharges in the neighborhood of such cables attacks unstressed rubber uniformly and very slowly. The presence of a very little mechanical tension in the insulation, however, is sufficient to localize the corrosion to a few deep cracks, which rapidly extend to the core of the cable and render it useless.

THINGS TO REMEMBER

By Proverbious

A single fact is worth a shipload of argument.
A poor workman quarrels with his tools.
A good action is never thrown away.
Be slow to promise and quick to perform.
Better do it, than wish it done.
Conceit may puff a man up, but never prop him up.
Do not throw your opinions in everybody's teeth.
He that stays in the valley never gets over the hill.
Sloth, like rust, consumes faster than labor wears.

Plans of the Canadian Steel Corporation

Plant Now Under Way at Ojibway Indicates That This Company Looks for Big Developments in Canada—Planning for a Steel City There of 25,000 People

THE Windsor district of Ontario, to which the name Border Cities has been given, is one of the most flourishing industrial centres in Canada at the present time. With the influx of automobile manufacturers and other industries of like nature, a rapid growth is taking place. It also bids fair to become one of the bigger steel centres in Canada, for when the Canadian Steel Corporation complete their plant at Ojibway, not only will the steel now imported into the country by the U.S. Steel Corporation, the parent company, be supplied by a home industry, but export trade may also be developed.

In the establishing of this steel plant a departure in design has been made from one of the practices of the U. S. Steel Corporation. The mills of the company in the United States specialize in particular products, that is, the whole output of individual mills is devoted to one particular class of steel product. Here, on the contrary, the whole steel industry will be represented in the products turned out; structural shapes, rails, rod, sheet and plate, together with tinplate and wire will be manufactured, the different plant units being added as need arises.

Several million dollars have already been spent in actual construction work and drawings and plans have been finished for the whole development.

A Steel City of 25,000?

A site of some two thousand acres has been purchased which will accommodate both the steel plant proper and the company's industrial town of Ojibway. This latter has been laid out for the accommodation of a community of 25,000 persons. The steel plant site has a frontage on the Detroit River of two miles, and the town development is located behind that portion reserved for the plant.

The ultimate size of the plant will be on a generous scale. As laid out at present twelve blast furnaces are provided for, with a possible two additional. These will be of 500 to 550 tons daily capacity each. At the present time four only of these will be installed, the remainder being left for future requirements.

In addition to these open hearth furnaces will be erected. Present plans call for two or three groups of fourteen open hearth furnaces of the stationary type, each of 75 tons capacity. The capacity of each group will be in the neighborhood of 750,000 tons per annum. As an alternative to the above it is possible that duplex process of the type used at the Gary mills may be used, and in this case two 250-ton open hearths will be erected together with two 25-ton converters. This plant would have a capacity of 50,000 tons a month.

The Talbot process, by which these open hearths would be operated, does not require the use of any scrap for the making of steel, but is able to use the molten iron from the blast furnace as the sole raw material. The iron is first partially blown for the removal of the silicon and a varying proportion of carbon and is then transferred to the open hearth. About one-quarter to one-third of the finished steel is tapped at one time, the remaining portion of it being left in the furnace to dilute the impurities contained in the pig iron and to supply the heat necessary for the keeping of the slag very fluid. Addition of lime and iron ore or oxide are made as slug-making materials, and after the slag has formed the molten iron is run in and a violent reaction takes place, most of the phosphorus and silicon being removed in the first few minutes.

With the four blast furnaces considered as present equipment and with sixteen 75-ton open hearths, approximately 1,000,000 tons of ingots will be made per annum.

Blooming mills will be installed to take care of the product of the open hearth plants and the rolling mills also contemplated will manufacture nearly every line of rolled steel products. A combination structural and rail mill, a plate mill, a bar mill, rod mills and wire mills will be erected, together with finishing mills for wire products. Tube mills and mills for the manufacture of sheet and tin plate are also among the future possibilities.

Present Status of the Development

While considerable development work has already been done, the magnitude of the work is not apparent at first sight to the casual observer. This is so for the reason that most of it is underground and the substructure of any building or work of this nature, while inconspicuous, when finished is exceedingly important and costly.

The ore dock and blast furnace foundations consist of concrete work of considerable magnitude. The blast furnaces will be erected in a line at right angles to the river frontage, and for the accommodation of the ore vessels a slip has been partially completed. This slip for the present is 2,400 feet long by 202 feet between dock walls, and will be completely dredged out to a depth of 23 feet. The method of making the dock walls is of much interest. Excavation was made to the bottom of the concrete walls and pile foundations were driven to solid rock some seventy feet below. On top of these the concrete was poured and the dock walls finished in dry land. When the concrete had set and when the work had advanced sufficiently, a sand dredge was employed to remove the earth intervening between the walls. The sand thus removed served admirably as a fill for some low land on the plant site; 600,000 cu. yards of earth will be removed from the slip. At the present time this concrete work is completed and a considerable portion of the slip dredged out.

As mentioned before, the section completed at the present time is 2,400 feet in length. Later, when expansion is necessary, a further 2,000 feet will be finished, making the total length 4,400 feet. The width of 202 feet is sufficient for two boats to tie up at opposite sides and a third to pass between them.

The snubbing posts are of special design, constructed so far as is humanly possible to avoid accidents in mooring. Hand chains are also provided at water level for the saving of any workman unfortunate to tumble off the docks, and ladders are provided at intervals for his gaining access to the level above.

The portal is 400 feet wide, the convergence to the width of the channel inside all being made on the down stream wall. The end of each dock wall makes a right-angled turn and these portions of the walls are securely braced back by heavy reinforced concrete beams, all converging to a common centre. Later, slag will be used as a filling material.

Some movement was naturally to be expected when the slip was dredged out, and this was provided for. About two inches lateral movement was found. About forty feet back from one dock wall is placed a reinforced concrete structure which serves as a runway for the boat unloader and also as a retaining wall for the stock pile; beyond this wall is tied in to the dock wall with heavy reinforced concrete beams every forty feet or so, and in turn it is tied in to the stock pile wall some 600 feet beyond. Conduits are provided in it for power supply to the unloader, and a tunnel runs its full length. This latter serves to lighten the wall and at the same time provides a place for racking pipes, etc.

Excavation has been made for the foundations of four blast furnaces together with their stoves, and foundations have practically been completed for two of them: 12,000 yards of concrete will be used in these foundations. In building them piles are driven to rock bearing as thickly as possible, and on these is laid 15 feet of limestone concrete. This is followed by five feet of gravel or silica concrete, and on top of this 12 feet of firebrick will be laid before the blast furnace is erected.

Two stacks together with their stoves are now in the course of fabrication as well as the steel for a machine shop.

Copper by-product coke ovens will be erected, and their capacity will keep pace with the demands of the blast furnaces.

Shop Photography

THE need of a special department of this nature is coming to be recognized as an important adjunct to the selling and advertising end of the business.

by *E. F. Hetherington and J. H. Moore†

TO anyone in the manufacturing business the value of good photographic reproductions of their product can hardly be over-estimated.

It is becoming a more established fact as time goes on, that good photographs are of the greatest assistance to the sales department, securing orders in many cases where the prospect was doubtful. Another advantage of using the photographic method of showing your product is in such cases where the carrying of samples is impossible. Take, for example, a large marine or power plant installation. A series of photographs forwarded to a prospect showing similar installations to that which he requires cannot fail to carry considerable weight.

Manufacturers who depend on outside photographers to supply their work are very often disappointed at the results obtained. This is due to the fact that the local photographer rarely pays any attention to commercial work, and is, therefore, unfitted for such work, having neither the equipment or experience, not to speak of technical knowledge.

Because of this fact, and other important reasons, many manufacturers are installing their own photographic department to work in conjunction with their advertising and sales departments. The advantages of such a movement are ovious, chief among them being the quality of the work obtained.

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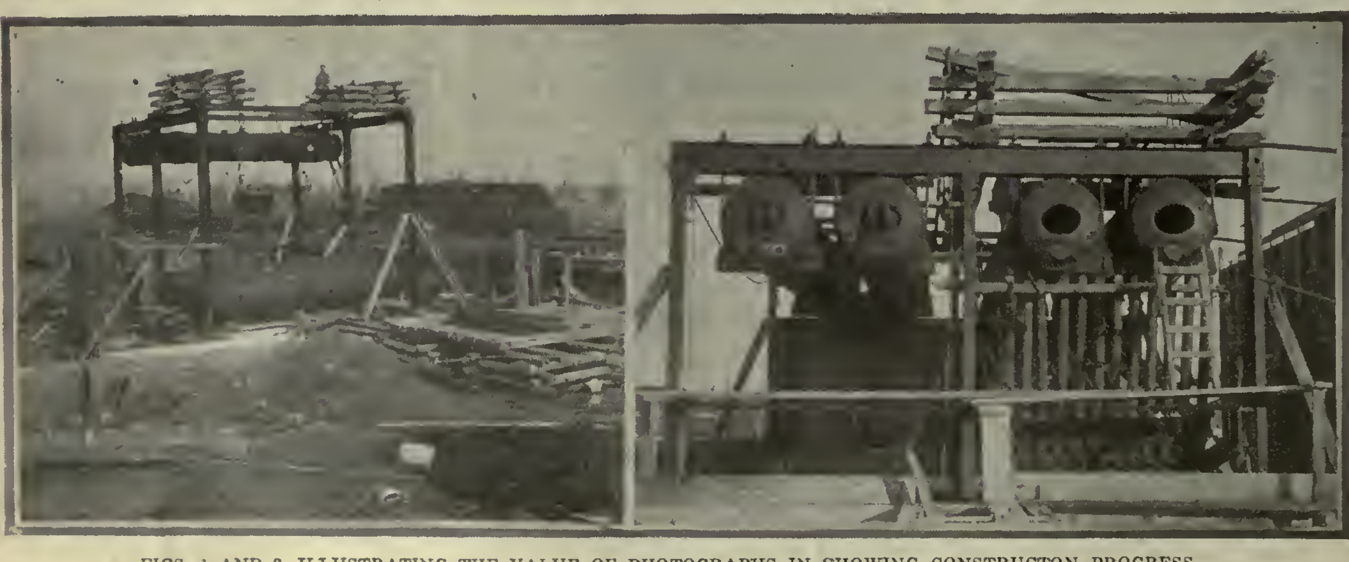
†Associate Editor, Canadian Machinery.

Quality of Work

Having your own photographer, he naturally becomes familiar with your product and develops a sense of mechanical values, which is most important in order that the greatest possible value as a selling aid may be found in the photograph. By specializing on any one line of product the photographer is enabled to bring into prominence the important details that have real sales and educational value, as well as additional artistic merit.

When a photographer realizes that success to a great extent depends on his efforts, it is his best work only which you procure. His subjects are always arranged to make retouching as small an expense as possible, the plates are exposed and developed with greatest care, while the prints he delivers are of the best quality he can obtain from his negatives. In other words, he takes a personal pride in his work. This is especially true if his efforts are commented on and appreciated.

The efficient service obtainable proves a most important advantage over the usual outside method. Perhaps you wish some prints in a hurry. With the outside photographer this becomes quite a problem, as three or four days is not an uncommon time to wait for prints ordered from outside sources. In many cases the print becomes of no value through arriving too late for its sales pur-



FIGS. 1 AND 2, ILLUSTRATING THE VALUE OF PHOTOGRAPHS IN SHOWING CONSTRUCTON PROGRESS.

FIG. 3.—RECORD PHOTOGRAPH SHOWING STYLE OF WRENCH BOARD SUPPLIED WITH CERTAIN INSTALLATIONS

pose, proving once more that it pays to conduct your own photographic department.

With your own studio, finished prints from existing negatives can be delivered to the sales department at an hour or two's notice, an advantage not to be overlooked.

Another strong point in favor of one's own photographic department is the question of expense. It will be found that considerable money can be saved through conducting a studio at the plant. In place of the usual three to four dollars per exposure, you will find the expense cut to a considerable extent, not to speak of the advantage of getting the exposure just when you want it. A commercial photographer does not answer one's beck and call, for he has other lines to attend to, and often you must wait his pleasure before obtaining the desired picture. The advantages of having your own photographer have been clearly pointed out and the reader, no doubt, convinced. We will now state what has proved to be a successful equipment for average conditions.

What Equipment Is Necessary

As the great majority of work will necessitate the taking of the complete kit to where the work is, we should secure an outfit which is easily portable, yet not lacking in utility. Any of the modern type of view cameras which has a focal length equal to at least twice the diagonal of the plate used, will do nicely. This focal length is necessary in order to obtain good perspective in our subject.

In photographing machinery we should get far enough away from the subject in order that our perspective and proportions are good, filling our plate by using a long focus lens. The extension bed on a view camera admits of this long draw of bellows. Another desirable feature is the sliding block under the bed of the camera, which is so arranged that the weight is well balanced over the tripod, and not all in front as would otherwise be the case. This is a great convenience in wide angle work, or when working on a slippery floor, for one can balance the camera with less danger of upsetting. For illustrative purposes, we will mention the photographic outfit as used by the Goldie & McCulloch Co. of Galt.

Starting from the ground up, we first come to the tripod. This is of the regular wooden type, which folds up and goes into the camera case. It should be sufficiently heavy to form a solid foundation for camera. The camera used is of the Premo view type, fitted with a series 7A Ziess-Protar anastigmat double lens, working at F 6.3. This lens is made by the well-known firm of Bausch & Lomb. It is so arranged as to give two focal lengths. With both lens in position, a focus of 9¼ in. is procured, but with either the front or rear combination used separately, it gives a focus of 16⅛ in. The advantages of such latitude are self-apparent.

The Work Room

The lens works in a volute shutter which varies from one one-hundredth second exposure to three seconds, in addition to the usual bulb, and time exposure points.

Entering their room, we find the following equipment: First, the regular developing tanks, fixing tanks, print washer, plate washer, etc., etc., which require no detailed mention. Next comes the contact printing apparatus which we will dwell on for a few moments. This printing box is equipped with a 500-watt nitrogen lamp, which gives ample light for the purpose.

In front of the printing light is a flashed opal glass for evenly diffusing the light, but installed in front of this again and operated from a foot treadle is a pair of sliding wings in which is placed a safe light color for printing purpose. The object is obvious. When loading paper in the printing frame, these wings are in front of the printing light, making the light perfectly safe. By pressing the foot treadle, these wings come out, allowing the bright light to print the required work. Immediately the treadle is released these wings, operated from springs, fly back into place, once more making the light safe for unloading purposes.

Before leaving the subject of printing, let us quote the method adopted for timing the prints. After a trial has been made and the proper exposure ascertained, a metronome, or in other words a musical time indicator is used. By adopting this method of timing one need not look at the instrument, but can count its ticks to a nicety, devoting all their attention to the negative, thus securing the best possible print. The printing frame used in an Eastman transparent backed swivel frame, having a capacity of 10 in. square.

The next, and very important, portion of the work

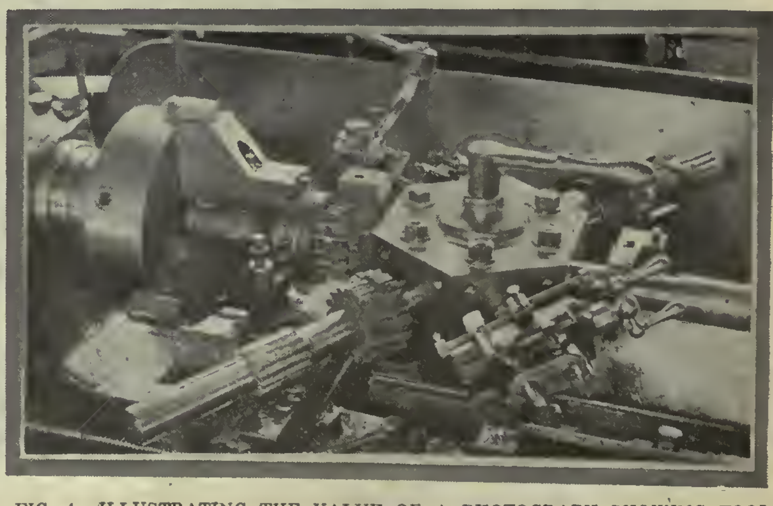


FIG. 4.—ILLUSTRATING THE VALUE OF A PHOTOGRAPH SHOWING TOOL SET UP.

room is that of the enlarging apparatus. This is a Folmer & Schwing outfit, Division of the Eastman Kodak Co., and its capacity is of course more than is ever required by a firm of this kind.

The lens used in the enlarging camera is the same as in the regular camera. This idea can often be adopted, thus saving considerable expense.

Another ingenious arrangement adopted by Mr. Hetherington is as follows: In place of the regular easel, or bromide paper stand on the floor, he has gone one better and built an overhead trolley arrangement to accommodate this part of the equipment.

The entire outfit is made of wood. Two rails run the complete length of the workroom. On these rails is a groove, in which run four stepped pulleys, which are attached in turn to the easel framework. By adopting this principle one is always assured of the easel being perfectly true with the lens of the camera. A tilting arrangement is provided on the easel, should it be desired to move one portion of the paper slightly nearer the lens.

The light for this enlarging outfit is supplied by a Cooper Hewitt type K.K. 3000 C.P. mercury M light. The peculiar shape of this light obviates the necessity of condensors. The tube takes the form of the letter M, in this way spreading the light evenly all over the plate to be enlarged.

Other fixtures in the workroom can be enumerated as follows: An Eastman Co. Safe lamp with Wratten slides to suit the various conditions met with, the regular film holders, plate dryers, etc. In fact, all the usual paraphernalia found in a room of such nature.

Varied Conditions

As shop conditions vary, it is impossible for us to lay down any hard and fast rule to follow. Light conditions are never the same in any two plants, machinery is often placed in very awkward places, and so on. We can, therefore, take only certain supposed cases for illustrative purposes and attack the problems in the best manner possible, storing this knowledge away for future occasions. When the actual photograph has to be made we must exercise our ingenuity to the best advantage and come out with results that prove that we understood our problem thoroughly.

Take for example Figs. 1 and 2. Here we note two views of the same installation, both exterior photographs. Being taken outdoors the exposure was a very short one, something impossible when picture taking inside the plant. Apart from the actual exposure of these negatives, what is the sales value of such pictures?

The photographs have both sales and educational value for the following reasons: As a record showing how the assembling of this installation was accomplished they are ideal, for they serve the purpose of depicting to others the system adopted. From a viewpoint of salesmanship they are also invaluable, for a prospect noting the methodical way in which the work was being accomplished could not help but be impressed by the standard of the company who wished to deal with him. In this way these pictures serve a double purpose at one cost.

Photographs As Records

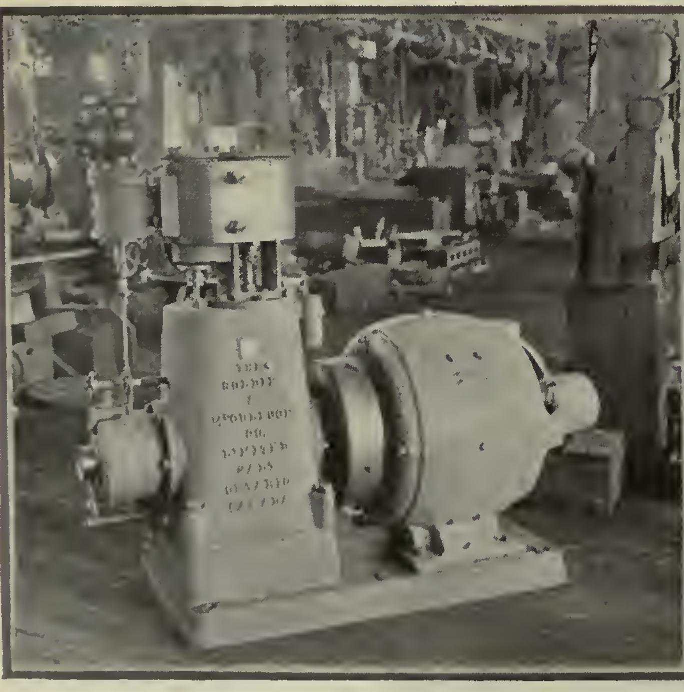
Photographs as permanent records are ideal in very many ways. They give a truthful representation of the object exactly as it appeared when exposed. Take for example Fig. 3, which illustrates a wrench board as supplied with certain installations made by the company already mentioned.

"How did we make up these boards for such an installation?" is a query often asked. Out comes the photograph and there you have all the details at your command. No guesswork, but plain facts are before you at once. It's hardly necessary to state that this condition means more efficient work, with no loss of time. The system of records can be applied to innumerable lines.

Let us consider another case, this time in a large manufacturing plant. Bill —— (we will call him that, anyhow) sets up the tooling on all the turret lathes while the various operators merely know enough about the machines to keep them running.

Suddenly without warning Bill gets sick. What happens? His assistant (if he has any) has to change over the tooling on one of the machines. "How did Bill fix these?" he enquires of the machine hand. "Search me," comes the reply, and the poor sub is very much worried. Loss of time results with frantic S.O.S. signs sent up to Bill. He in turn may be able to draw up a rough sketch of the arrangement, then again he may not. In any case they have a merry old time and all hands are thankful when Bill returns to work.

How different would have been the above story had this firm used a camera! They would have taken a photograph



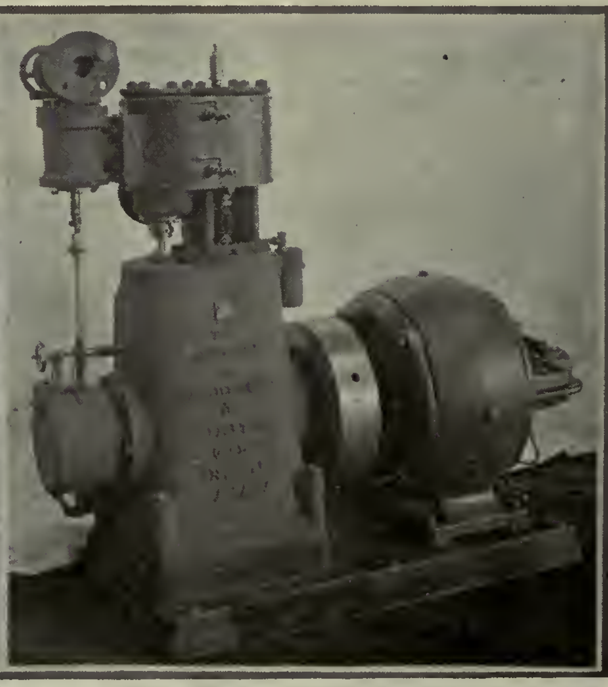


FIG. 5 AND 6, ILLUSTRATING THE BENEFITS DERIVED FROM THE USE OF A PROPER SCREEN.

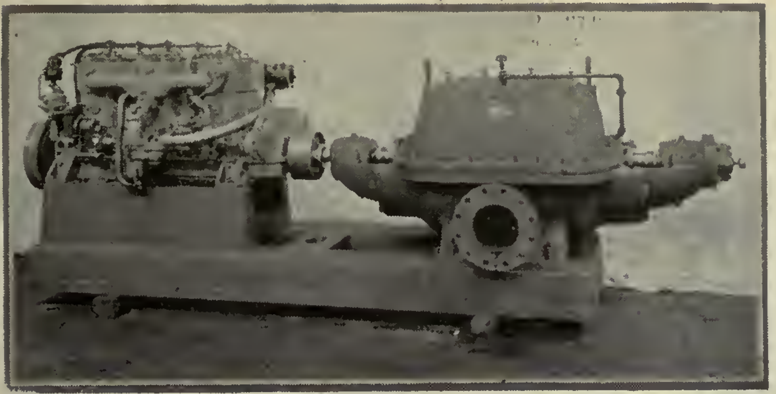


FIG. 7.—THE VALUE OF FLASH AND DAYLIGHT EXPOSURE. NOTE ABSENCE OF SHADOWS.

of the tool set up, the first time it was completed, and kept a print on file for such occasions. Fig. 4 illustrates the idea exactly. As soon as one looks at the photograph he grasps the various details. Bill becomes unnecessary, the change is easily made and production goes on without interruption. Which is the best system?

The Use of the Screen

When photograping any machine it is always advisable if possible to use a white screen behind it, as this arrangement shows up the picture to better advantage, also saving money on the retouching process.

At Fig. 5 we illustrate the photo with all its confusing background in detail. Not only does the background detract from the subject itself, but it means extra work in the retouching department. Contrast Fig. 5 with Fig. 6.

A white screen has been used in this case to splendid advantage. It is sometimes good practice to scatter sawdust or wood chippings on the floor around the subject, or to work on a portion of floor space that has been specially whitewashed, but these points, of course, depend upon the color of the machine, its shape, etc.

When using a screen it is advisable to keep it in motion, otherwise all wrinkles, dark spots, etc., will show up, making the picture very poor in appearance. Note the smoothness of the background in Fig. 6, yet this screen was both soiled and creased. The moving of screen is easily accomplished. Have two men behind, instructing them to move it sidewise slowly, and as evenly as possible.

The Value of Flash Powder

We could go on enumerating countless cases where by a little ingenuity money can be saved in the later processes, but our space is limited, therefore we must proceed to another section.

In securing photographs of any machine the chief object is to get away from shadows as much as possible. An evenly lighted picture is a joy to the photographer's eye.

We would not have readers infer from this that we advocate the use of flash powder alone, but it is our belief where daylight is procurable, that a combination daylight and flash exposure is ideal. Fig. 7, which illustrates a Ro-Turbo centrifugal pump directly connected to a gasoline engine was taken in this way. The even light with absence of shadows is especially noted in this photograph.

An open flash lamp is about as good as any for such purposes, but where smoke is an objectionable feature the smoke bag should be used. Study your shadows, and play your flash on the darkest portion, making sure your light is well behind the lens so that no lens glare can result.

To illustrate once again the value of a photograph for recording purposes we show Fig. 8. Here we see a triple expansion marine engine after assembly. The value of this photograph is again two-fold. First its sales value is self-apparent. A prospect can at once realize what he proposes purchasing, while from a record standpoint the photo is of great value.

It shows to advantage all the various piping, how it is bent and so on. It also illustrates the position of gauges, etc. In other words, to the shop it is a miniature reproduction of what they must build on some future occasion.

Blocking Out Negatives

This term blocking out is a familiar one to camera fiends, but not so to the tyro, so we had best explain the meaning of the term.

To centre attention on the object itself, the background is painted out with red or black opaque. This brings the entire ground up in white when printed, pushing out the subject in all its details. A small easel is usually made to finish such work with a light striking on the back of the negative, allowing the worker to see all points clearly. A good, steady hand is necessary. Where long straight lines appear on the negative it is a good policy to use a ruling pen for outlining such surfaces. Practice is really the big essential, the more you become familiar with the task, the speedier and more accurate becomes your work.

A good example of blocking out is shown at Fig. 9. This illustrates a compound marine engine. As can be noted by blocking out the rest of the negative, at once we concentrate on the subject itself.

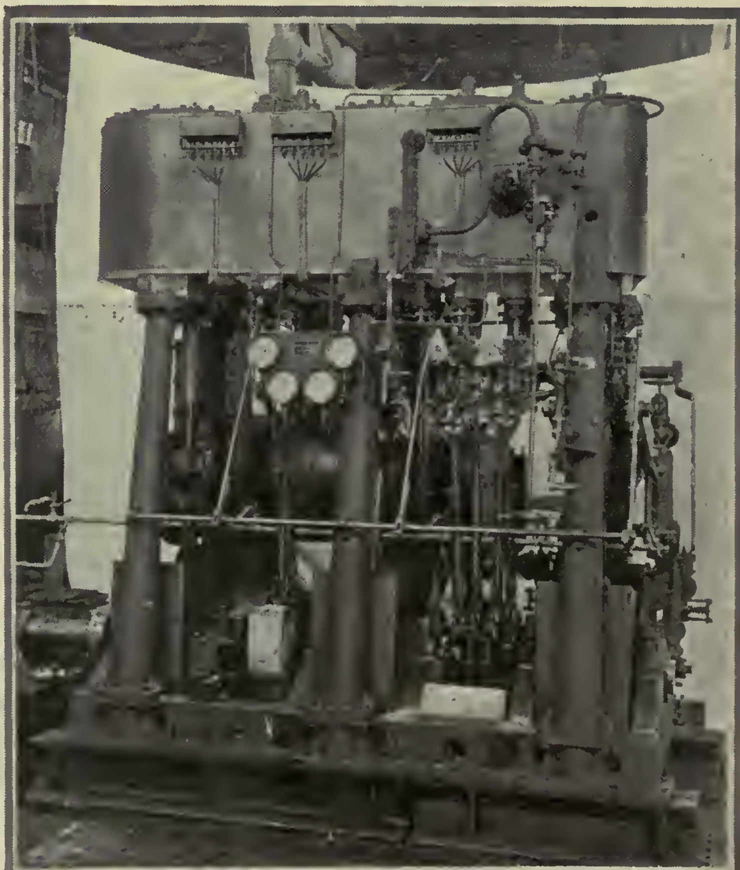


FIG. 8.—THE VALUE OF THIS PHOTOGRAPH AS A RECORD IS SELF APPARENT. PIPING, GAUGES, ETC., ARE CLEARLY NOTED AND THEIR POSITION CAN BE DUPLICATED IN LATER INSTALLATIONS.

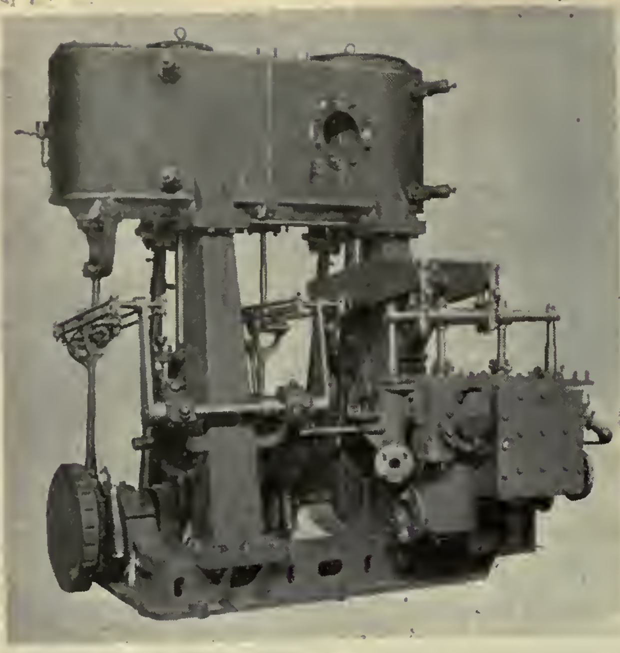


FIG. 9.—A NEAT EXAMPLE OF BLOCKING OUT WORK.

Another section which can be adopted to advantage is the photographing of the artist's retouch (from which the half-tones are made). In this way splendid finished prints are obtained, which will be found very useful in making up travellers' photo albums, and for enclosure with proposals, etc.

Fig. 10 illustrates a photograph of an installation at Montreal Mechanical School showing Heavy Duty Goldie-Corliss Engine. This was photographed from the artist's retouch, and the neat appearance of the print illustrates clearly the value of this class of photograph.

System of Filing

Any photographic department is behind time without a filing system. It should be so arranged that when a negative or print is required, one can put their hand on it at a moment's notice.

Every negative should be enclosed in a separate envelope on which should appear the title of the negative as well as the number. These should be filed on edge in a vertical cabinet similar to that used for ordinary correspondence filing.

A cross-card index, giving the title and number of each negative, makes them easily and quickly found, and after the required prints are made ordinary care should be observed in seeing that the negative is returned to the proper envelope, the number on which makes it practically impossible to put it back in the wrong place.

The finished prints can be placed in folders and handled in a similar way.

It is important in filing both negatives and prints that numerous and intelligent headings be used, such as—turret lathe tool set-ups, automatic tool set-ups, watertube boilers, Corliss engines, etc.

For negative files a heavy pressed board guide with metal title holders will be found most substantial and conspicuous for sub-dividing the various classifications.

Some General Hints

If possible, have the machine to be photographed painted a grey shade. Above all avoid red or blue. Red means a black dismal photograph, while blue ensures the very opposite, the result being a white streak instead of the proper color value. It is not always practical to name the particular shade you desire, but by diplomacy and co-operation between shop and photographic department improvement can be made to a wonderful extent. Where some highly-polished surface appears, it is best to dull this down with suitable paste or chalk, to get away from the glare.

Should it be desired to show cap screws, nuts, bolts, etc., or letters on some casting, rub these with chalk, or cover with a thin layer of white lead. The letters can be painted with the regular white paint, as is often done.

Wherever a machine is taken, showing actual operation, be careful that the cutter or tool is really in a working position. It often occurs that you see some photograph showing the cutter in a position, that from a hard practical standpoint would be quite impossible. When including the operator of the machine, refuse to take the picture before he assumes a natural working position. The tendency of the operator is to pose facing the camera. Be careful to avoid this as the value of the print, from a mechanical standpoint, is materially lessened. His eyes should be on his work. It is often possible to take a picture of this nature without the operator's knowledge, but in the majority of cases the light is so poor that such a procedure is impossible. For this reason it is best to take the operator into your confidence, explain diplomatically, that without his aid your picture cannot be a success, then watch how natural he looks. A little encouragement is all he requires. When arranging machinery care should be taken to see that all small parts such as oil cups, pipe fittings, handles, etc., are properly screwed in place, and in proper alignment.

In some cases it is a habit to place wooden plugs in threaded holes to protect the threads. Watch this point, for many a photograph has been spoiled through lack of care on small details such as mentioned.

While it is not good practice, generally speaking, to use a wide-angle lens, it becomes necessary in some cases where extreme width must be obtained. For such work the firm quoted throughout this article, use a Cooke primoplane series .7A lens working at F 6.5. The principal objection to the use of a wide-angle lens is the difficulty in securing true perspective, and, owing to the small aperture focussing is made more difficult where light is scarce.

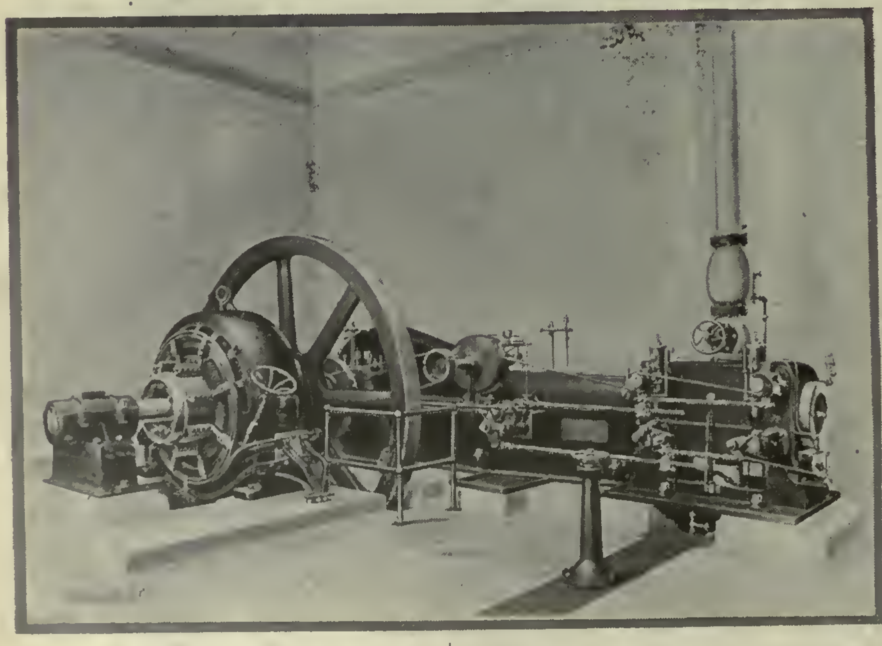


FIG. 10.—A GOOD EXAMPLE OF PHOTOGRAPH FROM ARTIST'S RETOUCH WORK.

When arranging a photograph, take your time. Study your picture. You have, we will suppose, reached the point where you are ready to press the bulb, or remove the lens cap, as the case may be. Before starting the exposure take a final look at the object to be photographed. It will pay you many times over, for countless pictures have been saved through this final glance. Other points to be watched will crop up from time to time, but experience is a great teacher.

A Suggestion

To those firms who feel that the expense of employing a photographer for their work is too great, we make the following suggestion:

Look around your plant. The drafting office is a splendid starting point, and ascertain if there is not someone who could accomplish this work in conjunction with his regular employment. It is a poor plant that does not harbor at least one photo bug. Like the poor, they are always with us. You will find this arrangement very satisfactory, for given the proper equipment to develop his ability, a photographer will break his neck if necessary to obtain results. Expense becomes a very small matter if this arrangement is followed out. Tall oaks from little acorns grow, and a humble photographic department started in this manner will soon make its value so apparent that it will expand in its usefulness as time goes on.

What supplies shall I use? That is the first question the tyro is apt to ask himself. In answer to this supposed query we would say, use only the best of everything. Good work requires good tools. The plates, or films, whichever you use, should be dusted carefully before being placed in holders. A wide camel's-hair brush should be used for the purpose. Developer should be kept at proper temperature and be clean. The same holds good for the fixing solution. Care and cleanliness should be the slogan of the dark room. For those readers already familiar with the art of photography we publish a formula used by Mr. Hetherington in the developing of prints. This formula is particularly adaptable for use with Azo paper, but will be found equally desirable for almost any quick printing paper. Clean, snappy prints are turned out by means of this solution. Following are the ingredients, which should be added in the order given, each one being thoroughly dissolved before another is added. The developer is non-abrasive.

Water, 40 ozs.; metol, 15 grains; sulphite of soda, 1 oz.; hydrochinone, 60 grains; carbonate of soda, ¾ oz.; potassium bromide, 25 grains; red prussiate, 5 grains; oxalic acid, 5 grains; potassium iodide, 5 grains. This developer is ready for use in this finished form. A feature of the developer is that it requires no alcohol as a preservative.

What One Firm Has Accomplished

In conclusion, we quote what the National Acme Mfg. Co., of Cleveland, Ohio, has accomplished in their photographic department. In common with other manufacturing companies they found a great deal of difficulty in securing suitable photographs from outside photographers. They established in 1910 their own photographic department as a branch of the advertising department.

In three years' time the department made itself self-sustaining, and proved to be a valuable adjunct to the advertising and sales division of the business.

Over 850 photographs per month were used for advertising and sales purpose, which means over 10,000 prints during the year. That was in 1913. Since then the work has still further increased. The advertising department uses all sorts of views of machines, parts, tools, etc., for many purposes. Photographs are sent to those enquiring regarding their products, and for sales promotion work. The pictures help to bring out the truth of the points stated in their various letters.

They use 8" x 10" cameras for general photographing, and an 11" x 14" for catalogue work. A 5" x 7" Graflex is also used on special work. Fouy lens are in use, viz., 19", one 12", one 8" Dagno, and one Bausch & Lomb Zeiss-Protor Series V lens for extreme wide-angle work.

In their case they bring the work to the studio. It is taken from the elevator by a portable crane, and placed on a turntable which allows the photographer an easy means of photographing the machine from any angle. It also allows him to take advantage of the best lighting available at the time. Artificial light is also used to penetrate when the daylight fails to go. A Cooper-Hewitt light is used as an auxiliary to the daylight in the studio.

Usually the machine is specially painted before exposure in order to reduce retouching expense as much as possible. The paint used is an oil paint which is flat but not a dead black. This paint dries smoothly and with just enough lustre to give the image a little snap.

For small parts they use what is known as a sky-scraper camera, placing this in a vertical position on a special stand and arranging the parts on a horizontal table. These few points will impress readers with the fact that this department is far beyond the experimental stage. Everything is worked out intelligently and with the idea of reducing expense always in mind, the result being a well-conducted and profitable department.

While the average concern cannot attempt to enter into this field on such a large scale there is no reason why they should not enter it on a more conservative basis. The day is coming when the up-to-date shop will conduct their own photographic department, as a necessary portion of their organization.

High efficiency in the sifting of sand is secured by a new "sand hog," which is electrically operated. The motor is suspended below the riddle, and by centrifugal force throws the sand toward the rim. The motor is cooled not only by the running sand, but also by the circulation of air through the hollow supporting members. The frame is adjustable for all standard-size riddles. The device, complete, weighs about thirty-five pounds, and is so compact as to require only a small amount of space. It may be easily raised or lowered to suit the convenience of the operator.

Lemen in St. Louis Post-Dispatch

THE EFFICIENCY EXPERT GETS BUSY, WITH THE RESULT THAT THE GIRLS CANNOT HOLD CONVERSATIONS OF UNDUE LENGTH OVER THE PHONE.

The Canadian Plant of Crane Limited

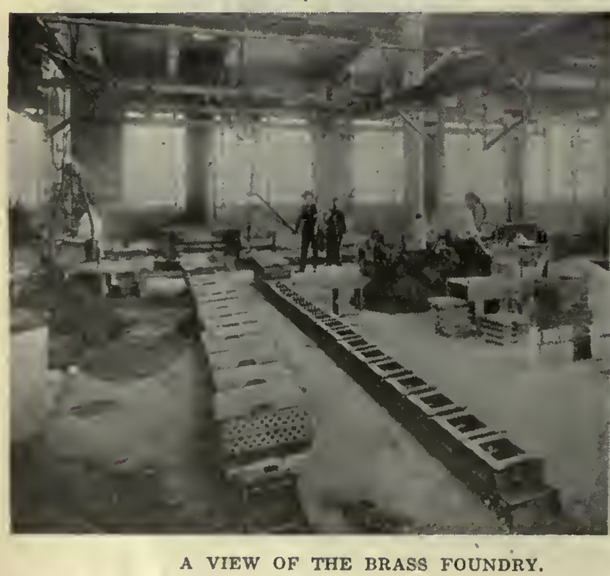
By J. H. RODGERS

ENGINEERING activities, for the purpose of developing trade in Canada, have made considerable progress during the past year, and the result of such action is already making itself felt. Many of the more recent enterprises — new to Canada — have doubtless arisen as a direct consequence to the change in world trade conditions following the close of the European war. However, there are some instances where new industries have come to this country—not as an aftermath of the signing of the armistice—but rather as a foresighted policy of old-established and progressive firms.

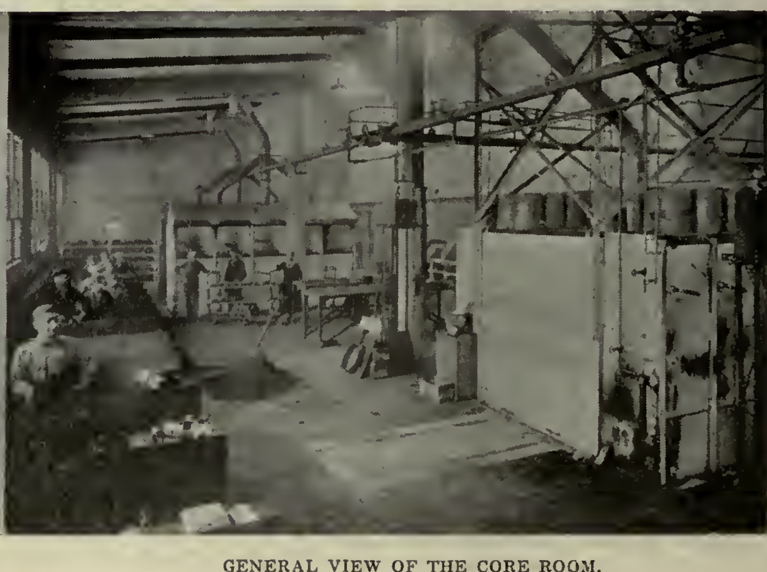
For some years past the Crane Company of Chicago has contemplated opening a manufacturing plant in Canada in order to take care of the rapidly growing demand for their lines in this country and others in the British Empire. The company of Crane, Limited, was incorporated in February, 1918, and a suitable site was secured at Cote St. Paul, on the south side of the Lachine Canal, and construction work commenced in September of the same year. Steady progress has been made on the buildings which were completed in the early fall of 1919. Since then manufacturing operations have been carried on and gradually increased as equipment was installed (they are rapidly approaching capacity production).

The main building is three storeys high and of reinforced concrete construction, and, as will be seen from the line sketch, the property is in the form of an irregular octagon, enclosing a considerable area in the centre, with ample accommodation for future additions to the present plant. One of the novel features in the layout of the plant is the location of the brass and iron foundries, both of which are situated on the top floor of the main building, with a portion still higher that serves as a charging floor for the cupola. This arrangement provides for exceptionally good lighting and ventilating facilities, the latter having received particular attention in consideration of the conditions under which the moulders are required to work. This not only provides ideal working environments, but facilitates the handling of the material from the casting to the finished product, allowing the natural force of gravity to minimize the physical effort which is too often emphasized in many industrial establishments. The floor construction throughout the entire manufacturing portion of the plant is of creosoted wooden blocks.

All raw materials, such as pig iron, scrap, ferro-silicon, sand, etc., are stored in the basement and arranged in piles and bins for convenient distribution to the different departments. Special machines are installed for machining the different valves and fittings. All



A VIEW OF THE BRASS FOUNDRY.



GENERAL VIEW OF THE CORE ROOM.

fittings are given a careful inspection before being placed in the stock department.

Core Making Department

The core room is on the same floor as the foundries, and is located midway between, so as to conveniently serve both departments. Arranged along the outside wall of the room are the work benches, made of sheet steel and each one fitted with a stool that can be swung beneath the adjoining bench when desired. The moulds in which the cores are made are of cast iron, machined on the inner surface to give a smooth, clean core. Three specially designed oil-fired furnaces—two small and one large—are located in the centre of the room. The door on the larger oven is of the balanced type, and band-iron safety guides are provided on either side to protect the workmen from the moving weights, and which prevent anyone from going directly beneath them, when they are in a raised position. The ovens are designed with small sectional side doors, for observing the progress of the drying process. Like all other departments the floors are of creosoted wooden blocks, with concrete inserts at either end of the furnaces, with inlaid tracks for the oven trucks. The transfer trucks which carry the cores from the benches to the ovens, and from the ovens to the stock shelves, are of the all-metal type, the platforms being supported on compression springs. This arrangement serves as a cushion and reduces the possibility of destroying the cores by jarring of the truck.

Brass and Iron Foundries

The sixteen pit furnaces in the brass foundry are arranged in a row along one side of the room. Two lightly constructed hand-operated traveling cranes —one in each bay—are used to transfer the crucibles from the furnaces to any desired location. A small air-operated hoist is used to remove the crucibles from the pits. Slightly-elevated portable floor tracks are provided to carry the all-metal trucks upon which the flasks are placed after coming from the moulding machines, which are specially designed for economic operation. All flasks are made of perforated metal, being light and durable. The electrically-operated sand riddles are suspended from short fixed runways that are in line with the lower crane rail, the latter serving as a convenient means of removing a riddle from one position to another, suitable electric and air connections being provided for the different equipment. The location on the top floor gives excellent light and the roof is provided with ventilators that can be controlled from the floor level.

The iron cupola is located at one end of the foundry, with the charging floor in a separate room and on a higher level. The most interesting feature in connection with this department is the overhead traverse system, the centre section laid out in the form of a race course, with radial feeders into the side bays. At the junction of the side rails with the main track a special swivel is installed, and so designed that it can only be turned when the side trolley track is in perfect alignment, so that it is virtually impossible to run the trolley off the track. The handle that operates the side crane also controls the locking dog, and the trolley can only pass back to the main track when this dog is in position. The openings in the floors that connect with the chutes to the mill room are protected with sheet metal hoods, with just sufficient space to push in the castings.

Cleaning the Castings

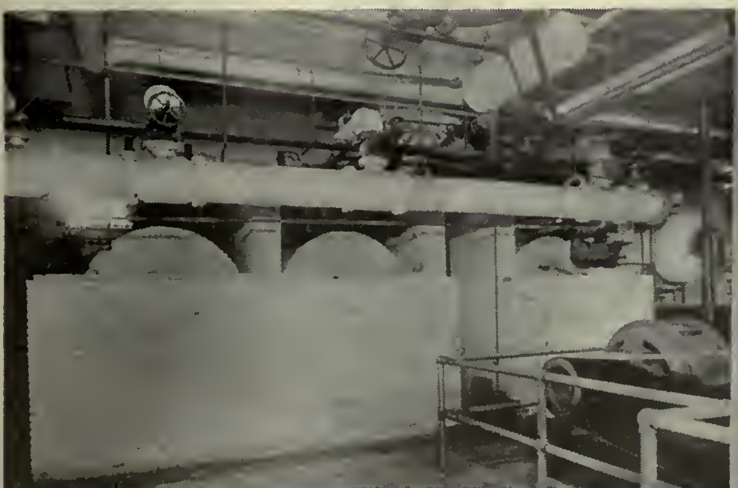
The mill room, which is located below the foundry section, is equipped with several tumbling barrels and heavy duty grinders, the wheels of the latter being protected by special sheet steel guards, the front slide being adjustable. To transfer the castings from the foundry to the mill room, special chutes are installed, down which the castings are delivered as they come from the moulds. At the lower end of the chute is a fair-sized hopper that retains the castings until the operator is ready to load the mill. This is accomplished by raising the hopper door sufficiently to allow the required quantity to pass into the mill, when the door is again closed. No lifting is required to place the material in the mill, but provision is made to raise large pieces from the interior by means of the small chain block that is supported on a trolley running on a monorail suspended from the lower portion of the inclined shoot. An I-beam monorail is suspended from the ceiling and supports a chain block, which in turn carries a steel bucket used for transferring the milled castings to the benches alongside the grinding wheels. Dust receiving pipes are fitted to all mills and grinders to take away all dust and carry it to the general storage bin above the railroad siding.

A machine of interesting design is that used for sand-blasting the castings. The body is made of wood and is fitted with a number of nozzles at varying heights around the circumference. Extending from the ceiling where the power is applied are a number of rods, which are revolved individually while passing around the central vertical shaft. In this way the castings are subjected to a steady blast on all portions before making the complete circuit. All the operator is required to do is to place on and remove the pieces from the hooks.

In the case of brass valve bodies, or other fittings intended for high pressure, the castings after sand-blasting, are given an individual hydraulic test, so that every piece going to the machine department is perfectly sound and free from defects. In the case of iron fittings the pieces are thoroughly inspected after coming from the mills, to eliminate faulty material before the same passes on to the machines.

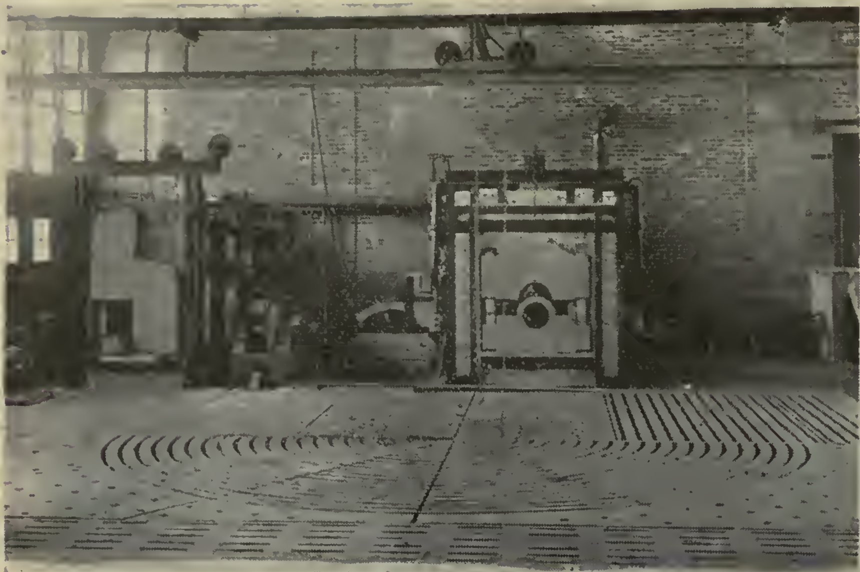
Pipe Bending and Storage

An interesting department is that division of the plant devoted to pipe bending; this branch of the company's activities marking a pioneer move in Canada in regard to work of this char-



GENERAL VIEW OF BOILER ROOM, SHOWING STEAM HEADERS AND RETURN SYSTEM.

A SECTION OF THE MILL ROOM.



PIPE BENDING FLOOR PLATES AND HEATING FURNACES.

acter being carried on on a commercial basis. The furnaces for heating the pipes are of the oil-gas type. The furnaces are arranged across one end of the room and are specially designed to meet the various requirements for pipe bending and flanging. The large one to the left is for heating long sections, the small one in the centre for local heating, and the one to the right is used for flange work. The Craneweld and Cranelap joints are also made in this department. The equipment installed is capable of bending and threading pipe up to 18 inches in diameter. Directly in front of the furnaces are installed a number of heavy cast iron floor plates, so designed and arranged as to take care of any class of bend. The centre plates are made with circular slots of different radii for facilitating the bending of the pipe to desired arc of contour. Several tons of auxiliary equipment, such as fixtures, forms, clamps, etc., are carried in stock and can be fitted to the floor plates with very little trouble. For the convenience of maintenance and repairs a space has been left below these plates. A hand-operated traveling crane is installed above the floor plates to handle the pipe during the bending operations. To the extreme left of the department is a deep pit, in which the pipes are placed when filling them with sand, this being an essential detail, where sharp bends are required to prevent distortion.

Adjoining the bending department is the pipe storage, the various sizes being arranged in racks for convenient access. Between the two divisions is a railway track, and an overhead electric trolley facilitates the loading and unloading of the different materials. A number of pipe threading machines are installed in this department.

Heating and Power Equipment

The buildings are heated with steam, three low-pressure boilers being installed for this purpose. An interesting feature of the heating equipment is the return of the condensation to the boilers without the use of pumps. This is accomplished by the use of Cranetilt non-return, three valve lifting and direct return traps, the non-return traps draining the headers, the three valve-lifting traps lifting the water of condensation, and the direct return traps delivering all condensation to the boiler. This not only gives a saving in fuel over the use of feed pumps, but allows the water to be returned to the boiler at a temperature higher than a pump could deliver it.

Electrical power is purchased from Montreal Light, Heat and Power Consolidated, and is brought in at 12,000 volts and transformed to 220 volts. In addition to the regular service line, an auxiliary line is brought in which can be used in case the main service line is cut off for any cause.

A notable detail of the power installation is the method of connecting each motor to an individual line that runs direct to the switch board located in the engine room. Each line is fitted with a circuit breaker, so when trouble develops the engineer has little difficulty in locating the cause. The system has the added advantage of minimizing shut-downs and inactivity in the plant.

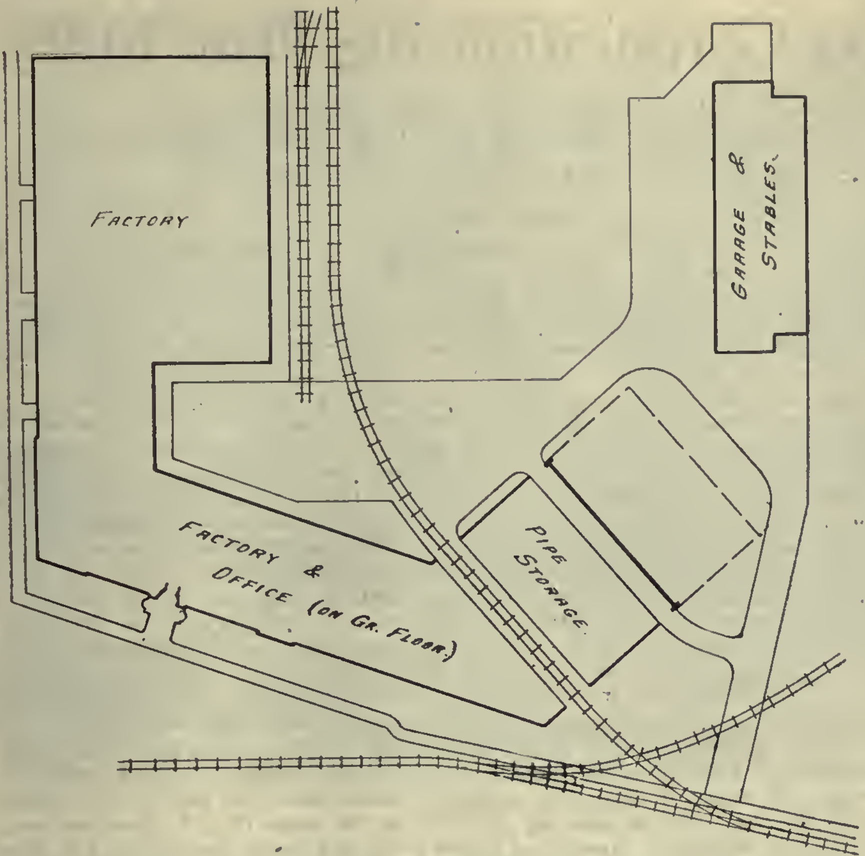
The compressed air supply for the plant is furnished by a belt-driven compressor driven by a 150 h.p. motor.

Stock Storage Department

Probably the most imposing department of the entire plant is the finished stock section, and a large portion of the ground and second floor are utilized for this purpose. The layout of the various divisions facilitates the stocking and shipping of the different valves and fittings, the bins for the heavier lines being on the lower tiers. To eliminate the necessity of using a ladder and at the same time utilizing the full height of the room, a platform gallery is provided that extends throughout the entire net-work of stock bins. Provision is made at the elevator shaft to truck the goods on and off the car at this level. A safety railing is fitted on the outer edge of the platform. Each section is set apart for a certain class of fitting and each individual bin is in-

PARTIAL VIEW OF THE FINISHED STOCK DEPARTMENT.

VIEW OF THE STABLES ABOVE THE GARAGE.



LAYOUT OF BUILDINGS.

dexed to specify the character of stock and for convenience of locating the same.

Stables and Garage

A highly interesting feature of the Crane organization is the care that is taken in acquiring horses for local and district delivery. The raising of the stock for many years has received particular study by Mr. Crane, and the majority of the local horses are of prize-winning stock, and no effort has been spared to provide comfortable quarters for the animals. The stables are located on the upper floor of a two-storey building, the lower portion being reserved for a garage and drive shed. In addition to the modern and well-equipped stables, the company has provided comfortable living quarters for the hostler, at one end of the stable, and every convenience, even to a shower bath, is furnished.

The comfort and the welfare of the entire staff of employees have been given particular attention. Lavatories, wash basins and shower baths have been installed in every department, and drinking fountains are well distributed throughout the entire plant. Needless to say, Crane fittings and equipment is used wherever possible.

Excellent shipping facilities are provided, as both the G.T.R. and C.P.R. have sidings into the plant. The plant is in close proximity to the Lachine Canal, and within a few miles of the Montreal harbor, so that ideal shipping conditions are available, both by rail and water.

The president of the Canadian company is R. T. Crane, Jr., and E. C. Townsend, 2nd vice-president, is the managing director.

Montreal is the head office and branches are maintained at Vancouver, Winnipeg and Toronto, where full stocks are carried. Offices and representatives are located at Calgary, Ottawa and Halifax.

Crane, Limited, also have a London, England, branch—Crane-Bennett, Limited, No. 45 Leman street, and have recently opened a sales office at No. 4 O'Connell street, Sydney, New South Wales.

RADIO ACTIVITY

Public interest in radio-activity has been heightened by Sir Oliver Lodge's picturesque description of atomic energy. In the December issue of "Engineering," the British technical journal, he says there are two concealed stores of energy not yet utilized, that of the Atom and that of the Ether. The energy of the Ether exceeds the bounds of imagination and is at present utterly beyond reach; but the energy of the Atom is not helplessly so. To quote:

"All atoms possess energy, but some cannot hold it all. These are the radio-active elements, and they periodically fire off projectiles with more than volcanic violence: A radium atom firing off a particle, which turns out to be a positively charged atom of helium, is like a two-ton gun firing a hundred-pound shot. That is about the actual proportion between the projectile and the rest of the atom, which naturally recoils each time it fires. The recoil has been observed. Before it has exhausted its ammunition it fires off five such projectiles, and then settles down into a quieter existence as lead—or, if not exactly lead, something chemically indistinguishable from lead. A uranium atom had already fired off four projectiles in order to become radium. Radium is a temporary half-way house between uranium and lead: it is active, but not so fiercely active as some of the intermediate substances which last so short a time that they barely have names. They destroy themselves by their own activity, and consequently are very scarce—like a population with a high death-rate. Radium is of moderate activity; its lifetime is of the order of a thousand years, whereas the lifetime of some of the intermediate substances may be measured in weeks or even minutes. Yet they are real elements, with a place in the series, and they have definite spectra and chemical properties."

Sir Oliver adds that it is not by any means their whole energy that atoms thus exhibit—it is the energy they expend and get rid of, their waste energy, that is perceived. The explosion is not the bursting of a gun, but merely the firing of a shot, except that in the atomic case the shot is far more than the energy expended. When its active transformations have ceased and left it in a stable state, like lead or gold, or silver or copper, or iron or any common element, we are not to suppose that because it is quiescent it has no store of internal energy. Cordite looks harmless enough, and so it is until a suitable stimulus is applied.

Sir Oliver asserts that there is enough energy in one atom to blow the submerged German fleet in Scapa Flow to the top of the highest mountain in Scotland. Let us hope that if science finds a mode of releasing atomic energy to the utmost, the discoverers will be friends of humanity.

Steam tube blowers, if not properly drained before using, will, when the valve is first opened, discharge considerable water as well as wet steam. This moisture causes an accumulation of soot between the tubes, particularly if there is a deposit on the bottom row. For this reason only dry or superheated steam should be used with steam tube blowers. The deposit of a clinker or scale on the bottom of the lower row of tubes is usually found with stokers using forced draft, and this cinder or clinker accumulation cannot be removed with the usual tube blower. It must be scraped off with hook or scraper. This is readily done since this deposit does not as a rule adhere strongly to the tubes.

Dominion Steel Corporation Big Plate Mill

Work Almost Completed for Turning Out Great Quantities of Ship Plate on the Eastern Coast—Views of the Plant Show Size of the Undertaking

CANADA has much to be proud of in her industrial development. The achievements of her manufacturers in supplying the much-needed war munitions have resounded through the world. She has created a shipbuilding industry during the last five years which can bear comparison with that of much older countries. Hitherto, most of the plates for the ships built in Canada have been imported; but, in the near future, these plates will be "made in Canada." The steel works of the Dominion Steel Corporation, at Sydney, C.B., will supply the ingots, and these will be rolled in the huge plate mill now being erected on the company's premises. This will be the first mill to roll large ship plates in the Dominion. The Nova Scotia Steel & Coal Company have a mill for rolling small plates at their New Glasgow plant, but ½-inch thickness is the limit of their capacity. The mill now in course of erection will roll plates up to 2¼ inches.

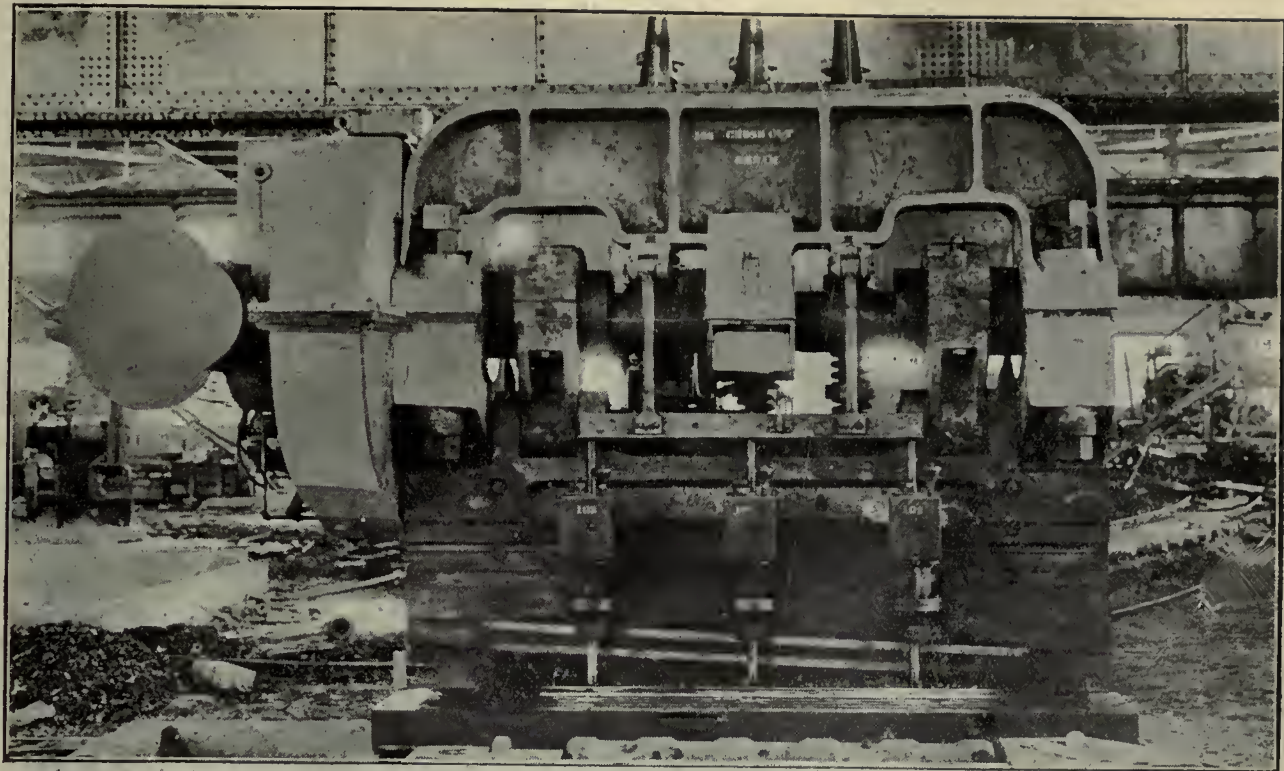
The idea of establishing a mill was developed during the early days of the shipbuilding revival, when the Imperial Munitions Board was getting steel ships built in Canadian yards. Considerable delay was encountered at various yards through difficulty in obtaining plates. It is probable that, even at that date, the idea of a Canadian merchant marine was germinating in the minds of the Government officers most interested. Naturally, the plate situation would claim their attention, and thus the establishment of a plate mill was first promulgated. The exact nature of the pour-parlers are not public property, but eventually the announcement was made that arrangements had been concluded between Hon. Mr. Ballantyne, on the one hand, and Mr. Mark Workman, on the other, representing the Government and the Steel Corporation respectively, for the erection of a plate mill. Work was started on June 15th, 1918, was stopped for two months from May to July, 1919, and is now rapidly approaching completion.

Some Particulars of the Mill

The mill will cost, altogether, $5,000,000 for construction, and will have a capacity of 12,000 tons per month. This means, in terms of days, 500 tons per day. Taking a definite size, say ½-inch thick, this becomes a capacity of 50,000 square feet of this thickness every 24 hours. The capacity of the rolls is from 3-16 inch to 2¼ inches in thickness, width of plate up to 80 inches, and length up to 80 feet. A plate rolling mill, of course, involves many more details than the rolls themselves. There are the open hearth furnaces where the steel is made and cast into ingots. There are the re-heating furnaces, or soaking pits, where the ingots are re-heated before going to the rolls. There is the conveyor, or hot bed, handling the ingot on the way to the rolls, and from them to the rolls which flatten and straighten any inequalities in the plate. There is the shearing machine to trim the plates to size, and castor conveyors and travelling cranes to handle the finished product for shipping or storing. Naturally, all this apparatus requires considerable room for its accommodation.

The buildings cover an area of 24,000 square feet, divided as follows: The furnace building is 140 feet by 227 feet; the conveyor, or hot bed building, 100 feet wide by 560 feet long. The mill building is 80 feet wide by 250 feet long. The slab crane runway is 80 feet by 200 feet; the shear building being 300 by 350 feet. The total length of ground devoted to mill operation is 1,260 feet. The plan of the building is in the shape of a T, the cross-piece, or top end, being devoted to the shearing and storing of the plates. The long end, or leg, contains the apparatus for handling the ingot as it comes from the heating furnaces, the rolling mill, flattening roll, inspection table, etc. In adjoining buildings to the rolling mill, or rather adjoining rooms, are housed the mill motor, scale pit and water tank. The buildings are of steel frame construction, on concrete foundations, and

THE ROLLS FOR THE MAIN PLATE MILL.



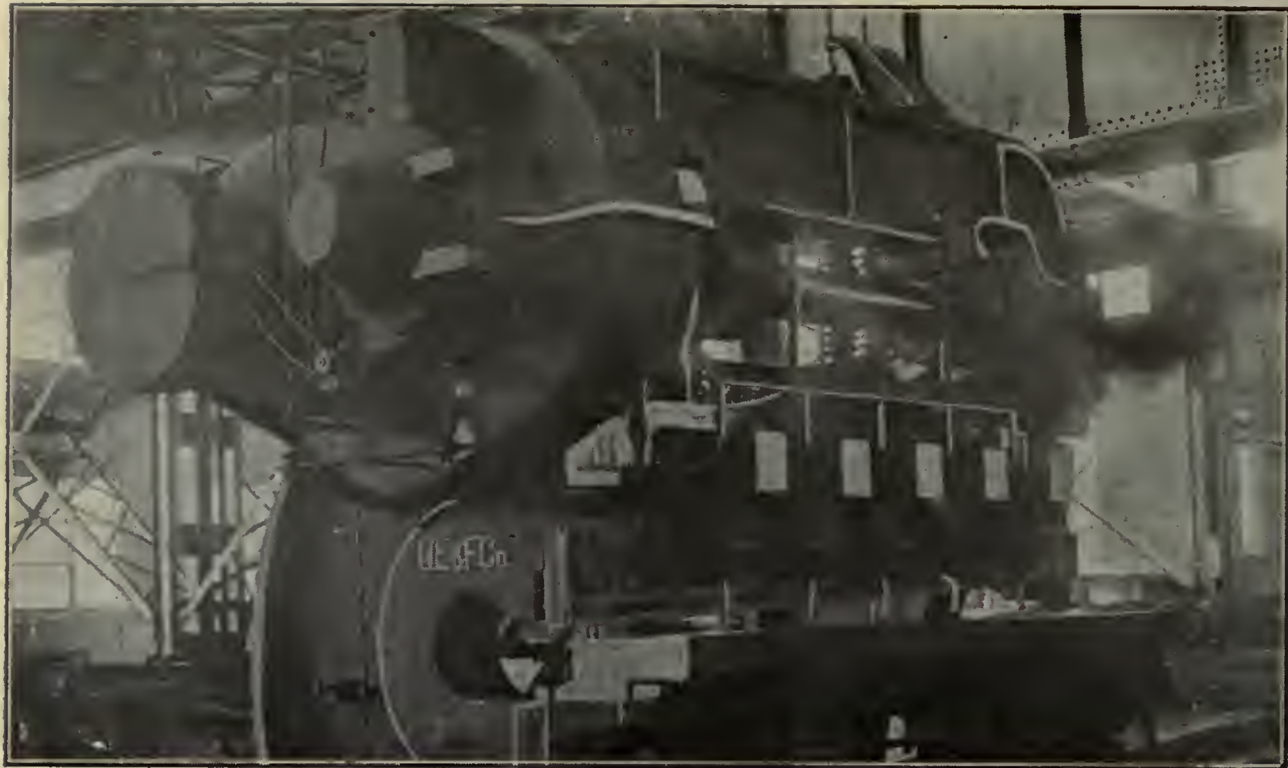
MACHINE FOR SHEARING ENDS OF PLATE.

the roof is supported on steel structural trusses, which eliminate the necessity of columns, and give clear floor space for the necessary operations. The roof is built with a lantern, for purpose of light and ventilation.

The Manufacturing Process

The ingot, as we have seen in an earlier portion of this article, comes from the open hearth to the re-heating furnace. These furnaces are four in number, and are gas-fired, regenerative, reversing type. Each furnace has a capacity of 8 slabs, 96 inches long. They are each 38 feet long, 9 feet wide, 7 feet high, and in the construction of all the furnaces and stacks 2,000,000 fire bricks have been used. To bring cold stock up to the heat required for rolling would require three hours; but, of course, the ingots are fairly hot when they are put in the furnace. The length of time they are kept in the re-heating furnace will, of course, depend on the speed with which the work is running through. These re-heating furnaces are often termed, in steel mill parlance, "soaking pits," and this is a good name. It describes, literally, just what takes place, the soaking in or absorbing of heat by

GENERAL VIEW OF SOAKING POTS.



MATCHING MACHINE IN SHEARING BUILDING.

the ingot while in the furnace. These ingots weigh anywhere from three to ten tons. The gas for the re-heating furnace will be supplied from the coke ovens of the company.

From Furnace to Mill

When the ingot has been sufficiently heated, the withdrawing crane is brought into play and reaches into the furnace. It grasps the ingot, hauls it out, and places it on an electrically-operated truck. This truck carries the blazing ingot to a table, which receives it, and then tilts up, shooting the mass of hot metal onto the conveyor. The conveyor leads direct to the rolling mill itself, and is continued on the further side of the mill to the flattening rolls. It continues again beyond these rolls till it meets a chain conveyor at right angles. However, the description is proceeding faster than the ingot, so we must retrace our steps. The conveyor is a roller arrangement, electrically operated and water-cooled.

The rolls, or the plate mill itself, is, of course, the leading piece of apparatus in the building. The mill is of the three high type, 36 ins. x 110 ins., the rolls being water cooled. It requires two thousand gallons of water per minute to carry off the heat imparted to the rolls by the hot metal. The mill complete weighs about 800 tons. The ingot passes through the mill between the lower and middle rols, and back again through the upper and middle rolls. After each pass the rolls are adjusted to squeeze the metal still thinner, till the desired dimension is reached. The whole operation is commanded by a man stationed in a controlling tower. other men are in attendance, but the gauges and indicators shewing pressures and thickness of plate are contained in the control car. The rolls will make a plate from ½ inch in thickness as a minimum to 2¼ inches thick as a maximum. This latter plate is, of course, not used for ship plating, but is required for heavy boiler sheets. Having been rolled to its approximate dimensions in the main mills, the plate is ejected on to the conveyor, which bears it along to the finishing roll. In this roll all inequalities are ironed out, and the plate is made commercially smooth. Once more the plate emerges on to the roller conveyor, and travels on towards its completing stages. The edges, not having been treated at all, are naturally rough, and the plate as a whole, though possessing one definite dimension, the thickness, must be brought to a size. The width is the first thing dealt with.

It will be understood by the reader that the plate, by the time it leaves the finishing roll, is cold or comparatively so. It would be too hot to place the bare hand on, but would be black. The trimming of the sides to the desired width is accomplished by passing the plate through two circular saws, which can be adjusted to any required width. The plate is forced through, the saws revolving and cutting through the metal with absolute undeviating precision. Thickness makes no difference, except that more power is required to cut the same length in the same time. If the thicker plate is fed through more slowly, the same power will suffice.

Having trimmed the sides, the ends of the plate are trimmed in a shearing machine. This machine will be familiar to anyone who has been in a shipyard or a boiler-making shop. It is really a large steel knife, contained in a heavy frame, and operated by a motor of sufficient power to force the knife through any thickness of steel that may be presented to it. First, one edge of the plate and then the other are brought under the knife, the power is applied, and the plate is completed and true to the required dimensions. These operations have brought the plate through the mill building and it now rests in the assembling department. The method of moving the plate around in this department is by rolling it over inverted castors, which are mounted on vertical supports. These castors are on ball bearings, and the plate resting on them can be moved with the greatest ease, friction being practically eliminated. It can be moved forward, backward, sidewised or diagonally as the situation requires. There are a total of 2,500 of these castors. The plate can be sent to the storage or to the shipping platform. Alternately it may be directed to any one of three shearing machines contained in this building. Two of these are arranged so that the plate may be cut diagonally, and the third is what is known as a matching machine, and is used to match different kinds of plate as required.

To serve the mill three travelling cranes are being installed. They are of ten tons capacity each and the tracks are carried through the entire length of the furnace, mill, assembling and storage buildings. There is a crane for the rolling mill proper with a capacity of fifty tons.

The Plate Mill Motor

To operate the plate mill 4,000 h.p. is required, and to provide this power an induction motor, operating at 6,600 volts, 60 cycle, 3 phase, is installed. It has a momentary overload capacity of 300 per cent. It has a speed of 82 revolutions per minute, the mill being geared down to 53 revolutions per minute. The floor

Continued on page 90

Shop Management---the Old and the New Idea

Being a Summary of the Changes in Management, Principles and Ideas During the Past Few Years—The Reasons Behind the Changes That Are Taking Place

By E. T. SPIDY, Production Engineer, C.P.R. Angus Shops, Montreal

WHO has not heard the saying "There is nothing new under the sun"—nobody, and yet when one comes to look back a few years to the time, say, when we served our own apprenticeship, we cannot but admit that something that did not exist at that time, something new, in other words, must have entered into the methods of shop management to bring about the great changes that we know have come about.

It is very fitting, especially at this period of the year perhaps, that we should give a little thought to such a subject as this and to follow the reasoning for the changes to be seen, if for no other reason than to give us a line on ourselves to find out whether we are in the "leader" class, whether we are in the "imitator" class or whether we are still "old style."

Perhaps I had better define what these three classes are a little more before going any further. Every man is a manager in the sense I am talking, whether he has to manage himself or whether he manages the largest business.

The second class I mentioned, the "imitator" class, does new trails. He has a line on all developments of his business, he follows the world's discoveries and "thinks" about them. He is one who noted keenly about ten years ago that a group of engineers started something that was called "scientific" management. He studied them to find out what they had that was new. Maybe he found it—perhaps he didn't, it is not the easiest thing in the world to grasp, but eventually, he decided that the principles of this group of men were right, realized then what they had was not anything new at all, it was merely a new application of the old stunt of specializing, which he had done for "years" in the shop, but had never applied it to the management of the shop. This manager "got" the big idea and has developed it some more still. There is always "some more" to develop. He is a "leader" because once he decided he stood behind his decision and made it go.

A Large Class This

The second class I mentioned the "imitator" class does not need much comment, although it cannot be passed because it is quite a large class. Our man here has followed, with dubious eyes somewhat, the progress of management by production specialists since the beginning. He hates to start. The war came and he in common with lots of us undertook his share to manufacture something essential. He saw again that the maximum output was only obtained by "specialists." He later on gets fidgety, because his costs are getting away from him and he then starts to "put in," as he says it, scientific methods himself. What result does he obtain? Nothing. Why? Because he had "not got the idea," he was not himself convinced and he really was giving it a "try out." There is no such thing really as a "try out." Scientific methods are a success or failure from the word go. A showdown comes quickly when you take from some of your old foremen some of the responsibility they have carried for years, and tell them that in future a special department will handle this; it either does or it doesn't depend on whether these making the change know what they are doing or not.

I called this class the "imitator" class, because it simply copies in detail what it has seen, read about, or heard of. No very great success can possibly come without the application of the principles being made to suit conditions as they exist.

Then the Stand-Pat Man

The third class, what I termed "old style," is the manager who does not see anything in these "new fangled" ideas. He will tell you he expects his supervisors to do this and that and so on. True enough he expects it, but does not get it. He can't get it if he supervises more than fifty men because it is more than one human being can possibly do—right. This manager never makes the deliveries he promises, does not know why his costs are high, because he can't pick out which jobs are the expensive ones. He only knows his final costs. He has his foremen and operators chasing around for material that should be at the machine. He has idle machinery—needless to say, he does not know how much, and so on. In other words, this manager still expects his supervisor to be an expert in half a dozen lines and refuses the entire output possible by a change in organization that gets everyone doing one job right.

We are all in one of these classes. It is in everybody's interest to be in the first class, because progress and prosperity to all are assured thereby. Goods produced at the right cost and sold at the right price have the greatest number of possible customers.

Production methods—what are they? Production methods aim to set a task that can be accomplished for every shop, department or man, and to co-ordinate, or bring together the operations of the whole plant to accomplish the tasks set.

The Canadian Pacific Railway Angus Shops at Montreal have adopted production methods which are applicable in principle to all manufacturing industries. While the Angus Shops are the largest of their kind on this continent, employing over nine thousand men at the present time, it is to be noted that they are made up of many shops, and the shops, of departments, all of which are supervised by foremen and assistants. I find it very difficult to think of any trades not represented at the Angus Shops.

Now, as in your own plant, you will recognize that every foreman does a certain amount of work which, if someone else qualified did it for him, would give him more time to look after his men and really supervise them. At the Angus Shops the Production Department undertakes some of these duties. It acts somewhat in the same capacity as a clearing house does for the banks. It being in direct touch with the Works Manager, it provides an "Operations due" sheet for every department every day. This means that it plans the work of each department for each foreman. It does this by a series of schedules and graphic charts, from which it takes off for each department a list of all operations that must be done each day. These "Operations due" sheets are all sent out the evening previous to the day it covers. Each day the Production Department checks each shop with its sheet, investigates and summarizes late operations, so that proper action may be taken to prevent them causing delays to output.

Another function of production methods as applied at the Angus Shop applies to material. Every foreman is dependent on the proper supply of material, whether purchased, manufactured or finished stock being available when it is required. Instead of each foreman having to trace his own material from stores or whatever the source to the shop, an especially trained material tracer from Production Department handles the entire transactions. Failure to get any required material results in it being placed on special lists which get the attention of proper officials. When it is seen that deliveries will not be made in time, arrangements for substitution are made as quickly as possible.

At the Angus Shops there are functional foremen who check all the work done in each department from a point of view of the efficiency of the individual operations. It must be noted that in the performance of these duties, the Production Department does not act in a way that the foremen of the shop is ignored. Quite the reverse is true. Before any function is taken over and also at every change in policy or program, the foreman is consulted and agrees that the final modus operandi decided on is to his best interest. These systems, having now been in effect for nearly two years, have proven to all that the Production Department is out to boost each man's output by making it possible for him to do it. Foremen have confidence in the work because they realize that a single department tracing all sources of information must be able to do it better than they could individually.

In the development of this work also we make the greatest endeavor to disperse any idea of mystery such as one unacquainted with how it is done is liable to. This being an unfortunate situation brought about by the crop of so-called "efficiency" men who discredited the real thing just before the war. Naturally, a foreman at first feels that it is not possible for an outside department handling so many other departments to cover the ground properly. Our answer is: "Come and see, there is nothing about it you won't understand in a minute. Everything we have is an open book and we "want" you to know just what we do do." The result is co-operative effort. As each man understands he uses. He realizes that in the head office there is a record of his own performance and he endeavors to make it show right. To the foreman it is a satisfaction, if he is the right kind of foreman, to know that the manager knows hows he is doing. The manager has also the satisfaction of really knowing what is going on, what is causing delays and why. There are many other phases to this work which need not be enumerated here. Sufficient is it to say that specializing carried beyond the shop is the real thing and time will show it to the doubters, when they find themselves at the tail end of the race. The ideas are logical and necessary to meet the social changes of to-day's world.

Which class are you in—and why?

Rules for finding length of crossed belts. First find the length for straight belt. Square each the diameter of the large pulley and distance between centres. Add together and extract square root of sum. Subtract from this the distance between centres. Multiply the remainder by two and add to length of straight belt as previously found. The result will be the length of crossed belt.

Belt slip. As a belt depends entirely on its power of adhesion to the pulleys to perform its function, see to it that its power of adhesion is maintained at the maximum by not overloading, and by the consistent use of suitable belt dressing, sparingly but regularly applied. Do not allow the dressing to clog on the pulleys. As belt slip is such an insidious danger—it makes no noise—and may be going on unsuspected until irretrievable damage has been done to the belt. Begin the application of belt dressing immediately the belt is put into use.

Rules for finding length of belt required. When it is not convenient to measure with the tape line the length required, the following rule will be found of service: Add the diameter of two pulleys together, divide the result by two, and multiply the quotient by 3 1-7; add the product to twice the distance between centres of the shaft and you have the length required, substantially. If one pulley is considerably larger than the other, a little extra allowance should be made, because the distance from the centre of the top of one to the centre of the top of the other is a little greater than the exact distance between the centres of the shafts.

To ascertain the number of feet in a roll of belting. Add diameter of roll in inches to diameter of hole in centre. Multiply the result by the number of coils in roll, and then by 132; the three left hand figures being the number of feet in roll.

A process by which fibre of good quality can be manufactured from the bark of the Australian eucalyptus tree consists in passing the bark through a "softening" machine to loosen out the fibres, and then through specially adapted carding and spinning machines. The inventor of the process has opened a factory near Melbourne, where samples of twine, rope and bagging, for the manufacture of which the fibre is chiefly utilized, are exhibited. It is claimed that these goods are equal in quantity to the best flax and Indian jute goods, and can be produced at half the cost. Waste fibre is employed for furniture stuffing, fibrous plaster work, placing refrigeration chambers, etc.

A novel method of storing coal in carbonic acid gas, which combines the advantages of the overhead bunker with the absolute safety of storage under water against spontaneous ignition, has been adopted in an installation described in the "Iron and Coal Trades Review" as having been recently erected at Dortmund, in Germany. It consists of three cylindrical bunkers—with semi-spherical tops and bottoms—each bunker holding 2,500 tons of coal. There are three outlets in each bunker for withdrawing the coal and three holes at the top for receiving it; the lower outlets close gas-tight, whilst those on the top, though requiring a good fit, need not necessarily be gas-tight, since carbonic acid gas is nearly twice the weight of air, and does not therefore escape at the top. A simple structural steel tower unloads the coal by grab from a barge; the coal is then shot into a small hopper from which it is fed on to a push-plate conveyor, the path of which completely envelops the three bunkers in the vertical plane. It can therefore both feed and reclaim the coal. There is a slight leakage of carbonic acid gas during the withdrawal of the coal, but this is stated to be small, and can be easily replenished.

An investigation of the temperature of a 24-in. ingot during the process of heating it up to forging heat is described by Mr. F. E. Bash in a paper read before the American Institute of Mining and Metallurgical Engineers. He says that after seven hours' heating the surface temperature may be 2370 deg. Fah., while the temperature at the centre is 2287 deg. Fifteen minutes after the ingot was taken from the furnace the corresponding temperatures were 2125 deg. and 2280 deg. respectively. Mr. Bash thus comes to the conclusion that, although it is possible to heat a 24-in. ingot from room temperature to forging temperature in seven hours, the question is raised whether this fast rate is not injurious to the steel. While the steel is still comparatively cold, large stresses are set up which may cause internal fissures. The rate at which an ingot can be heated without injury depends on the kind of steel, chrome steel being very tender, while low-carbon steel will stand more abuse.

In his presidential address to the Institute of Engineers and Shipbuilders in Scotland, Dr. T. Blackwood Murray pointed out, as an example of the advantage of using special steels, the fact that the weight of a motor car gear is less than 12 per cent. of the weight of an electric crane reduction gear transmitting a similar load at similar speeds. He also dealt with the increasingly important part being played by aluminium alloys in the construction of motor vehicles and aircraft, and said that particulars of a new light piston alloy, the chief constituent of which is magnesium, with a specific gravity of 1.74, had recently appeared in America.

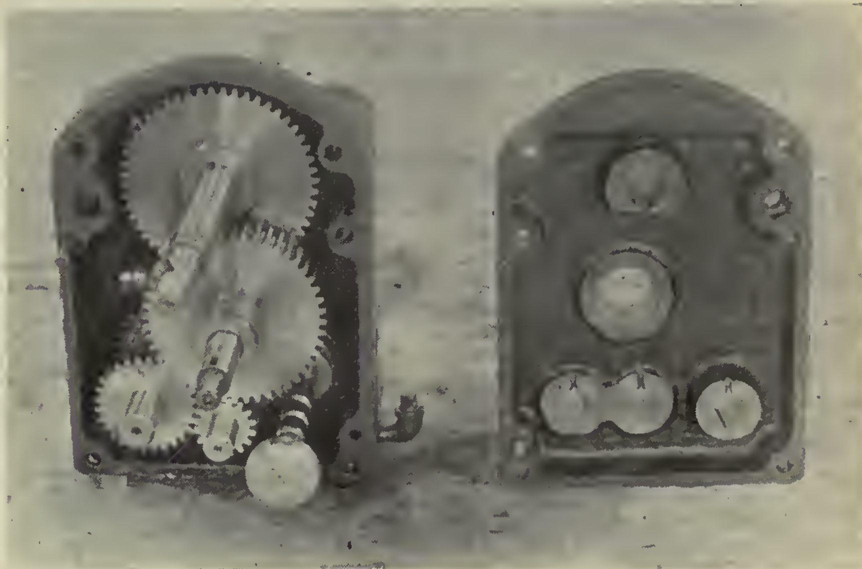
The permanent field magnets used on magnetos are easily recharged by inserting them in solenoids wound for a current of 20 amperes at a potential of 6 volts so they can be coupled up to an automobile starting system battery of that voltage. The connection is made only for an instant as several contacts of a second's duration are all that is needed and this will not injure the battery. It is stated that a freshly charged tungsten steel magnet of a large magneto will lift in the neighborhood of 20 lbs. as ordinarily energized.

DEVELOPMENTS IN SHOP EQUIPMENT

FOSTER NEW LINE OF HAND SCREW MACHINES

The Foster Machine Company of Elkhart, Indiana, has recently designed and perfected a complete line of hand screw machines embracing five sizes. These are to be known as the Nos. 0, 1, 3, 5, and 7 Screw Machines, and the sizes of same are, respectively 7/16 in., 13/16 in., 1-5/16 in., 1-13/16 in., and 2-9/16 in.

Several new features, which will be described, have been perfected and incorporated. Taken as a whole, the machines do not represent any radical departure from established practice, but are built upon fundamental principles of correct machine design incorporating the best features. They represent the latest and highest developments in this branch of the machine tool industry. The design is founded upon a knowledge of work performed on this type of machine and of a keen understanding of the possibilities of still further widening of the field for same. The material used for each individual part throughout has been given a thorough study.



NO. 2 SCREW MACHINE APRON FOR TURRET SLIDE AND SADDLE.

The power and rigidity provided is in excess of the requirements made necessary by the latest developments of high-speed steel and stellite. The margin above these maximum requirements has been added with a view in mind of taking care of and providing for any additional improvements in cutting steels.

Three different styles of cut-off units, viz., the lever feed cut-off, hand screw feed cut-off and power feed cut-off are being built. These are interchangeable and either one can be furnished as required. The power feed to turret is a separate unit and a machine can therefore be built with either power feed to turret slide or with hand feed. The automatic chuck and bar feed are independent units and can be furnished or not as required.

The No. 0 and No. 1 Screw Machines, which are of 7/16 in. and 13/16 in. bar capacity respectively, are designed for high-spindle speed and sensitiveness of operation so essential in machines of small bar capacity. They are built in the three-step cone pulley Plain Head type only. The turret slide, which is operated by means of a hand lever, has an effective longitudinal movement of 3 in. for the No. 0 Screw Machine and 5 in. for the No. 1 Screw Machine. The No. 0 Screw Machine can be equipped with a compound rest, which is interchangeable with the lever feed cut-off ordinarily furnished with this machine.

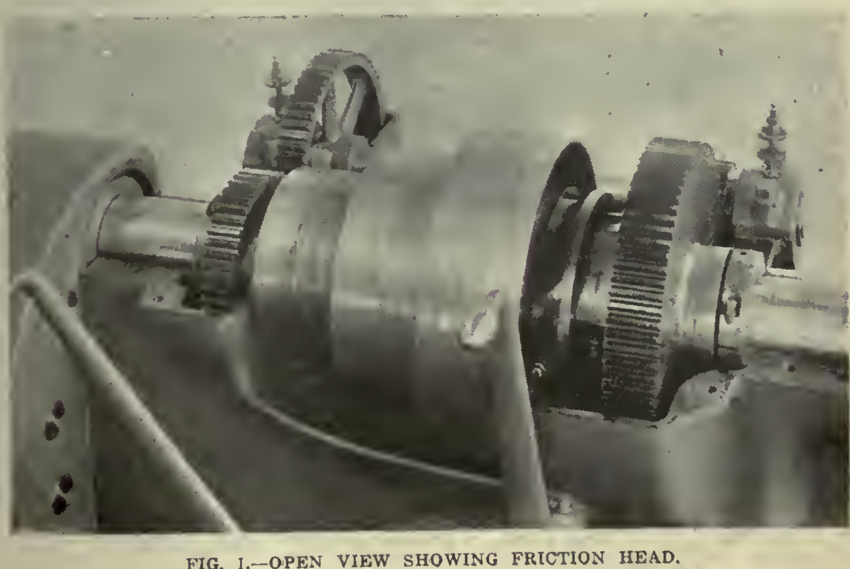


FIG. 1.—OPEN VIEW SHOWING FRICTION HEAD.

The No. 3 Screw Machine, the bar capacity of which is 1-5/16 in., is built in both the Plain Head and Friction Head types. No. 5 and No. 7 Screw Machines, of 1 13/16 in. and 2 7/16 in. bar capacity respectively, are built in the Friction Head type only. The large diameter cone pulley and the powerful friction provide more than ample power for the heaviest requirements. The turret slide has an efficient travel of 7 in. for the No. 3, 9 in. for the No. 5 and 11 in. for the No. 7 Screw Machines.

Design of Head

The half-tone figure, No. 1, shows the gear friction head for the No. 5 Screw Machine. The gear covers and spindle caps have been removed in order to more clearly show the design. The powerful friction clutch, mounted on the spindle between the cone pulley and the friction gear, serves to engage the spindle into driving connection direct

FIG. 3.—APRON FOR NO. 3 SCREW MACHINE, WITH POWER FEED CUT OFF.

with the cone pulley on one side or with the back gears through the large diameter spindle gear on the other hand. The frictions are of the cone type and are operated by the hand lever through the medium of a long movable sleeve and four fingers mounted on the spindle. The friction is very sensitive in operation and extremely powerfud.

The front and rear spindle bearings are made of special high-grade bearing bronze. The spindle is made of high carbon steel forging.

The head is cast integral with the bed. The rigid double girder type of bed is very heavily ribbed internally and is designed throughout to gain the maximum rigidity without the use of unnecessary large amount of cast iron.

Automatic Chuck and Bar Feed

The automatic chuck is of a standard spring collet type. The automatic chuck hood and spindle nose have been designed so as to gain as short overhang as possible from the front spindle bearing. The collet operating mechanism differs materially from the design which has heretofore been used.

Instead of the well-known sliding fork principle the fork lever principle has been utilized. This eliminates the cocking action and the unduly large amount of friction in the already mentioned sliding fork type operating mechanism. The automatic chuck fingers have been equipped with rollers to eliminate friction at this point.

The bar feed operating mechanism is also new in design. For the No. 0, No. 1 and No. 3 Screw Machines the single supporting rod is used, but for the No. 5 and No. 7 Screw Machines the stock support slides on two parallel bars. The continued motion of the automatic chuck lever, as it opens the collet, feeds the bar forward. This is accomplished through a system of links and levers in such a manner that the automatic chuck and the bar feed are operated intermittently.

Turret Slide and Saddle

The No. 0 and No. 1 Screw Machines are equipped with the round turret, while the No. 3, No. 5 and No. 7 Screw Machines, owing to the fact that flanged tools are desirable for the heavier work done on these machines, have the hexagon turret. As already mentioned above the turret slide on the No. 0 and No. 1 machines is operated by a hand lever pivoted on the top of the slide near the rear end of same.

The turret indexing mechanism is very sensitive in operation. The vertical lock bolt is mounted underneath the front side of the turret virtually directly beneath the working tool.

Fig. 2, which is a view of the No. 3 Turret Slide and Saddle, with the slide tipped up and standing on front end, shows clearly the main working parts of the turret indexing mechanism.

Attention is called to that, the end of the lock bolt lever, which intermittently engages the tumbler for withdrawing the lock bolt preliminary to the indexing of the turret, is equipped with a roller for the sake of the sensitiveness and reduction of wear.

The rearward travel of the slide indexes the turret by means of indexing pins in the bottom of the turret and a pawl pivoted in the saddle.

The No. 3, No. 5 and No. 7 Screw Machines are equipped with a system of revolving independent stops which are geared to the turret and index with same. The stop screw working in conjunction with the working station of the turret abuts a movable stop in the saddle. This movable stop stands in working relation with the mechanism disengaging the automatic feed in the saddle apron.

The system of independent stops for the No. 0 and No. 1 Screw Machines differ considerably from the one just described for the larger Screw Machines. Instead of having the stops revolve with the turret, the stops are mounted in the end of the turret slide. A revolving stop working in the slot between the two lugs on the rear end of the saddle indexes with the turret and acts to bring the proper stop into working relation with the forward turret station.

Additional sensitiveness of indexing is thus gained as the stop screws do not have to revolve with the turret. This is a vital point on a small machine working on delicate work. Its importance can readily be appreciated when attention is called to the fact that frequently several hundred parts can be turned out per hour on this machine and that every one of these pieces might require the turret to be indexed several times. The design of the turret indexing mechanism is the same as on the larger machines.

Power Feeds

The half-tone, Fig. 3, shows the interior view of the power feed apron for the turret slide. Three sliding gears provide means for obtaining the feed changes. These three changes are multiplied by a cluster of two sliding gears in the gear box at the end of the ma-

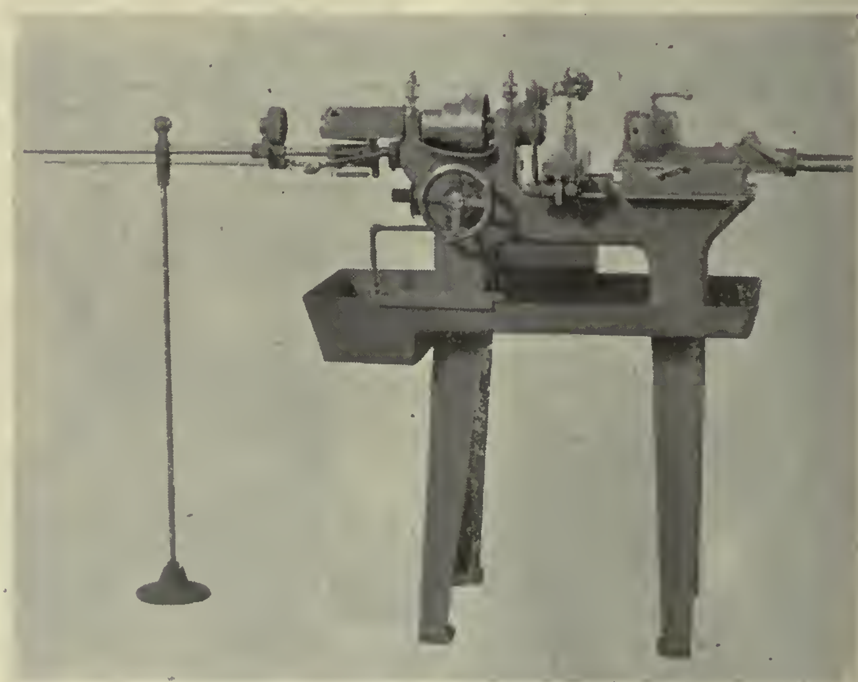


FIG. 4.—NO. 0 SCREW MACHINE—FRONT VIEW.

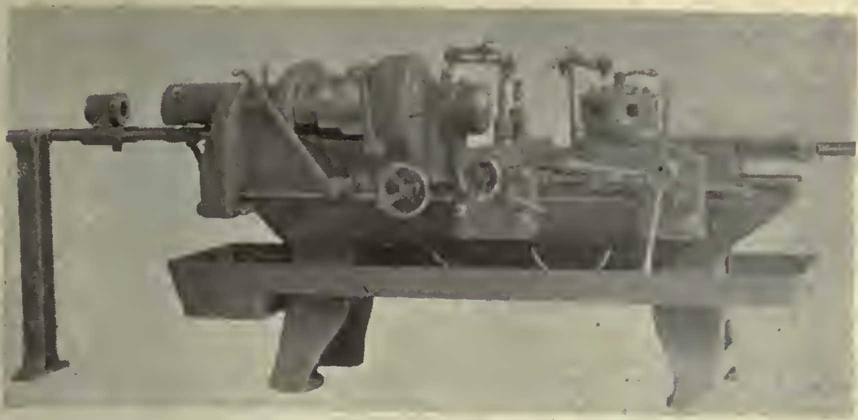


FIG. 5.—NO. 7 SCREW MACHINE—FRONT VIEW.

chines. This provides six changes in all. The power feed is engaged and disengaged by a friction working in conjunction with the gear engaging the large driving gear of the pinion shaft. The face cam on the outside of the apron and the drop-out lever serve the purpose of engaging the feed friction. This drop-out lever stands in working relation with the system of independent stops as already described above.

Attention is called to the fact that the apron is filled with oil up to a certain level, and that, therefore, the lower gears in the gear train, including the worm gear, run in a bath of oil.

The cross feed apron shown by the half-tone, Fig. 4, is similar in design to the saddle apron, with this difference, however, that additional sliding gears are introduced in the train to obtain the reverse of the feed movement. The feed friction which works in conjunction with the two large intermediate gears is operated by a rapid acting and powerful cam manipulated by a hand lever. This power feed apron, together with the carriage and cut-off slide, constitute a separate unit which is interchangeable with the hand screw cut-off, shown in the front view of the machine and also with the lever operated cut-off, either of which three cut-off units can be furnished at the option of the customer. The three-step sliding gear nests in the apron in conjunction with the two changes obtainable in the gear box, at the head end of the machine, as already described, provide six changes of feed to the cross slide.

FIG. 6.—NO. 3 SCREW MACHINE TURRET SLIDE AND SADDLE.

An important feature is the location of the hand longitudinal feed screw for the various cut-off units between the ways of the bed. The force moving the cut-off carriage on the bed is thus applied in the middle of the guide where same should be, instead, as is customary, on the front side, where it will cause a cooking action to be introduced resulting in inaccuracy of the adjustment and undue wear of the machine at this point. Immediately inside of the hand wheel for the hand longitudinal feed is mounted a large diameter graduated dial equipped with observation stops. This facilitates the ease of adjusting the cut-off carriage longitudinally. A similar graduated dial with observation stops is also mounted on the cross feed screw and used in conjunction with the movement of the cross slide.

Control Systems

Referring to the front views of the machines, attention is called to the centralized control and the ease with which the various control levers and knobs can be reached by the operator when standing in his natural position in front of the machine. The principal feed changes are located in the aprons, which is ideal. The lever operating the automatic chuck and also feeding the bar forward is within easy reach of the operator and, as has already been pointed out, operates with unusual ease.

For applying the proper amount of coolant to the work and the cutting tools, the larger machines are supplied with a double system of piping, one working in conjunction with the turret slide and the other with the cut-off. On the smaller machines, where a smaller amount of coolant is required, only a single system of piping is used.

The remaining cuts illustrate other general views of this line of machines.

GANG DRILLING MACHINE

A gang drilling machine of unusual design especially adapted for boiler shops, structural steel fabrication and ship-plate work has been built by the Hilldrill Co., 2141 North Nineteenth Street, Philadelphia. The drill spindles are chain-driven, and by virtue of the almost direct application of power, require a comparatively small horsepower consumption for the operation, enabling great latitude in the number of drills driven. The flexibility and strength of the chain drive also makes for a machine that is adaptable not only for heavy duty but for gang drilling on any type of work. The cycle of operations in the actual drilling is automatic and the spacing of the spindles is universal, above a minimum, which on the heavy-duty type here shown is 2¾ in. centres. This spacing may be cut in half by shifting the work.

The application of chain drive for drilling is the basic feature of the machine, which has been designed by Aaron Hill, 1028 West Forty-eighth Street, Los Angeles, Cal. The invention gives virtually a direct pull on the spindles and is found to eliminate power losses or chatter. On ⅞ in. boiler plate, drilling 44 11/16 in. rivet holes through plate and ½ in. inner and ½ in. outer butt straps, about 11 hp. net was required. The spindle sprockets engaging the chain are staggered, to distribute the load over the several chains provided; and the web of the drill carriage forms a lubricated runway for these roller chains and serves to prevent the chain from slipping off the sprockets.

The mechanism clamps the work in place with a pressure of about 10 tons, sufficient to straighten any ordinary sweep or buckle, feeds and lubricates the drills and at the end of the cut raises the drills, stops both the drills and lubrication and releases the work, all automatically.

A radical departure in drill design are the drill heads, built as independent detachable units. Each unit consists of a small bridge casting which straddles the chainway and is machined at each end to slide easily along the carriage rails. At the top and just above the spindle socket are hinged clamps operated by levers linked to the adjusting handle. In placing the unit in position on the carriage seats the clamping device is only partially tightened. The spindle is then racked into position by rotating the spindle by means of a loose lever inserted by hand in a drift hole in the spindle socket. Racking the spindles to correct centres is facilitated by means of a steel tape stretched across in front of the spindle heads. The units, weighing from 4 5to 65 lbs., are easily handled by man and helper, and the entire gang can be set in about 8 mins.

The accepted practice in drilling calls for higher speed and slower feed the smaller the diameter of the drill. This principle is automatically taken care of without changing feed or speed on the machine proper, but by corresponding differences in the design of the various size units. For example, a unit designed for a No. 3 socket, taking up to 1¼ in. drill, is equipped with a 10-toothed sprocket turning up to about 160 r.p.m., with an average feed of 0.004, while the unit for a No. 5 socket holding 3½ in. cutters is equipped with a 20-toothed sprocket turning 80 r.p.m. and feeding at an average of 0.008 per revolution.

To start the cutting cycle, the motor is started and the clutch thrown in. In the starting position the disk cranks hold the carriage just past the upper dead centre, so that the initial drill feed is a minimum, in the first stages approaching a maximum of 0.005 in. per revolution passing through the body of the work and automatically diminishing to about 0.003 in. at the break-through. This variable feed safeguards the machine against shocks and minimizes losses from breakage of drills by "hogging" on the break-through.

The drill units are locked into place by bringing the adjusting handle down tight, forcing the clamps home into grooves in the cross-rail. Keyways cut in the face of the lower seat and staggered serve to prevent any tendency on the part of the units to cock over while being racked into position. The drill heads are likewise alternately staggered, so as to insure a close setting where required.

During the return to starting position, a small cam on the hub of the large gear at the driving end operates a lever to throw the clutch out and break the motor circuit, bringing the entire machine to a standstill.

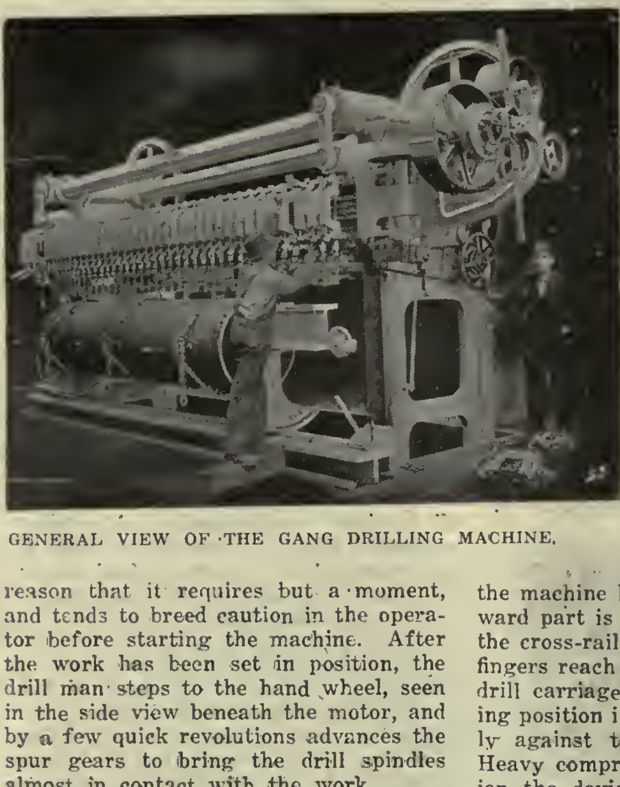
The machine is adjusted to feed slightly beyond the break-through before reaching the lower dead centre; and upon passing this point 600-lb. counterweights on the two large spur gears simultaneously pass over the top point of equilibrium and throws out of balance, whirling the spur gears through an arc of 180 degrees and raising the drill beam back approximately to starting position.

The lubricating system is especially noteworthy. A shallow trough directly behind the spindle sockets is filled with lubricant to a depth of about 1 in., from which it is fed mechanically through independent lubricating units to each drill individually. These units are essentially a disk carried on a hollow spindle suspended from the drill housing. The disks carry fins or ribs on the back, curved to pick up on these narrow shelves driblets of the fluid, which are run centripetally by a slight oscillation into holes through the hub opening into the hollow stem. A small downward pitch to the stem suffices to carry the cutting compound out on to a gutter on the spindle, bored to drop it through so as to run down the drill surface. The units are turned back and forth approximately 180 deg. by a small connecting rod and piston driven off the shaft pinioned to the worm gear. A quadrant lever oscillates a chain which turns the lubricators by means of sprockets just back of the disks.

The driving chains run over sprockets at each end of the cross-rail. Those at the left end run on idlers. At the right hand end of the machine they are keyed to the same shaft as the flat at bevel gear driven by a bevel pinion on the shaft carrying the pulley belt-driven by a 50-hp. alternating current motor which is rated to run at least 60 1-in. spindles through 2 ins. of soft steel.

The drill feed mechanism is operated by the worm gear on the lower end of this driving shaft, which drives a chain actuating a gear keyed to a shaft running across the back of the machine and connected at each end by trains of reduction gears to two spur feed gears, 4½ ft. in diameter. These large spur gears are mounted on shafts, on the front end of which are disk cranks. The connecting rods, on which the drill beam is hung, are eccentrically mounted on the disk cranks, and at the lower end are pinned to the drill carriage.

The drill feed is, therefore, controlled by the rotation of the large spur gears. The adjustment of the drills to the starting position is done by hand, for the reason that it requires but a moment, and tends to breed caution in the operator before starting the machine. After the work has been set in position, the drill man steps to the hand wheel, seen in the side view beneath the motor, and by a few quick revolutions advances the spur gears to bring the drill spindles almost in contact with the work.



GENERAL VIEW OF THE GANG DRILLING MACHINE.

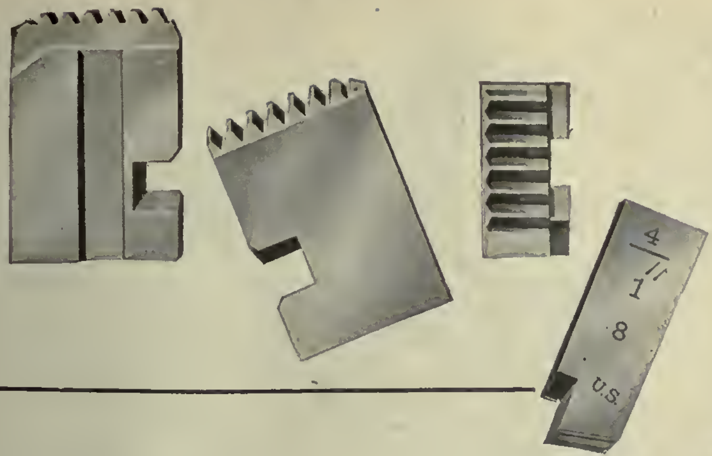
The low power consumption permits the use of this machine with great economies wherever multiple drilling through heavy sections is required, notable results along these lines having been accomplished at the plant of the Badenhausen Co., Philadelphia, in boiler making. As shown in the illustrations, the production of boilers is reduced to a manufacturing process.

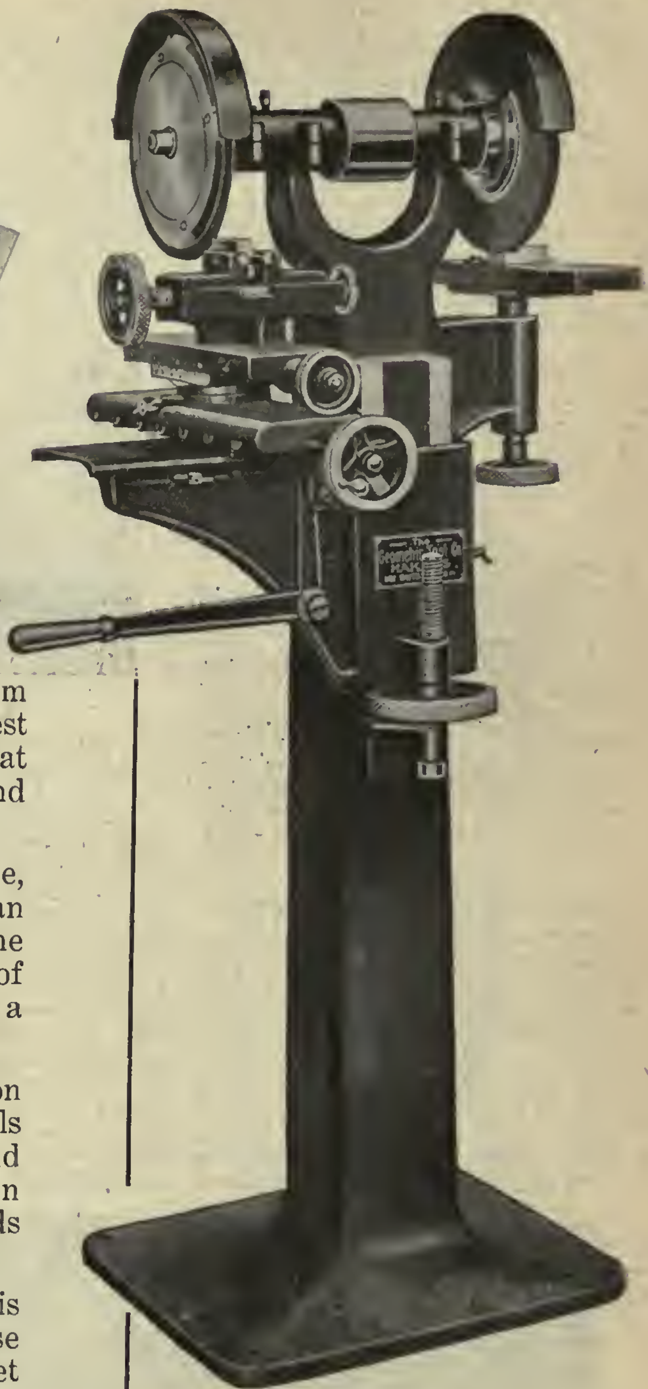
For riveting the boiler drum the plate is first rolled to shape. Then the outer butt strap is set along the seam of the shell and gripped in place by chain sling-jacks placed at intervals along the shell and tightened by hand lever to secure a perfect butt. For supporting the work during the operations use is made of a super-beam consisting of a special H-beam equipped at the head end with a caster. The inner butt strap is first laid on the beam, after which the tail is lifted by the crane and it is rolled through the shell on the caster. It is now slung on bow slings and then raised by the crane against the butt joint and screw clamps are placed at each end holding the parts firmly in place. The work so rigged for drilling is now set upon special rockers in position upon the drill table.

For most operations the base of the machine is set in a concrete pit and bolted in place. This brings the table about at floor level and the drill spindles approximately breast high, beneath the eye of the workman. The table is carried on two slides on the forward flanges of the frame and is raised and lowered by means of four 3-in. screws operated by worm drive, which on the machine here shown, for example, allows of work on cylindrical boiler drums up to 48 ins. in diameter.

The work may be done either in the flat or after rolling and shaping, carriages designed for the various types of work being readily fitted upon the table of the machine. The cross-rail carrying the drilling heads or units, a strong I-beam in section, is brought into position and the rigging adjusted to line the drills with the centre line of holes to be drilled. The work is then clamped, and the drilling started. For clamping the work and holding it secure while cutting is going on, a powerful lever clamp is provided. It consists in a heavy pivoted frame set inside the frame of the machine back of the drills. The forward part is linked to the upper side of the cross-rail, and at intervals clamping fingers reach out over the work. As the drill carriage is brought down to starting position it presses these clamps firmly against the material to be drilled. Heavy compression springs act to cushion the device and compensate for the vertical travel of the drill carriage. In the heavy duty plate drill the mechanism has a binding presure of about 10 tons; but this is variable with the strength of the springs.

The radii of the sectors or rings insures that the holes will all be at right angles to the shell, and inasmuch as the butt straps and shell are drilled simultaneously, all parts are bound to come "fair." As an oversize hole of but 1/32 in. is required for the easy insertion of the rivet, this clearance is provided for in the drilling and the time usually consumed in punching, drifting and reaming is done away with. The uniformity of the holes with proper riveting practically insures that the swaging of the rivet will completely fill the space, reducing





Sharp Chasers Cut Clean Threads

Accurate, uniform threads result only from dies which are maintained in the highest state of cutting efficiency. This means that chasers must be kept sharp, and ground uniformly.

Even if just touched up from time to time, the chasers respond splendidly, with clean threads. And with this machine—the Geometric Chaser Grinder—the matter of keeping threading tools up to scratch is a comparatively simple matter.

Various makes of chasers can be ground on this adaptable machine. The two wheels permit the easy grinding of both milled and tapped chasers. In addition, the plain wheel lends itself readily to various kinds of tool grinding.

Uniform grinding of a set of chasers is purely a mechanical matter through the use of adjustments which can be accurately set to govern the grinding of an entire set of chasers.

The Catalogue describing this machine is a mine of information on chaser grinding. Write for it

THE GEOMETRIC TOOL COMPANY

NEW HAVEN CONNECTICUT

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Wilson, Ltd., Montreal. The A. R. Williams Machinery Co., Toronto, Winnipeg, St. John, N.B.

the tendency to shear as a result of any unequal expansion and contraction of the shell. The necessity for first laying out and then centre punching each hole is dispensed with.

For drilling additional rows of holes, as in boiler or plate work, special stands are employed to suit conditions. For butt-strap rivet holes the super-beam becomes the bed of a cradle, which is set upon rockers and fastened by set screws. The rockers rest on curved beds, and are toothed along the outer half to mesh into pinions on a shaft extending between them. Detachable hand levers at the ends are used to turn the cradle until the next centre line is brought beneath the points of the drills. A pointed sleeve jig is slipped over the end spindles and slid down to touch the work until correct alignment is obtained. For appropriate work, such as drilling tube holes in water-tube boilers, the shell is placed in rings instead of a cradle.

The type of machine built for heavy work is designed for a length up to 40 ft., or to carry not less than 75 drills; but it is stated by the manufacturer that any desired number of drills and any span may be had. The illustrations are of a model of 20 ft. working span weighing about 25 tons. When running there is an entire absence of jar or vibration, the only sound audible being the quiet hum of the drills cutting into the metal.

6-TON VOLTA FURNACE IN POURING POSITION.

VOLTA ELECTRIC FURNACES

The electric furnace has become the recognized means of making the steel necessary for the steel foundry. Canadian steel plants have been fully aware of the advantages offered in economy and ease of operation and the installation of Canadian-made furnaces in the plant of the Dominion Foundries and Steel Co., Ltd., Hamilton, is a feature worthy of note. This firm manufacture carbon and alloy steel castings and are now operating the two 6-ton furnaces recently installed by the Volta Manufacturing Co., Welland.

These furnaces, while of the Heroult type, contain a number of exclusive Volta features which make for improvement in operation both as regards ease and economy. They are installed on the open hearth floor of the main foundry building, and, owing to the necessity for keeping the charging floor in the rear free for the open hearth charging machine, the transformer rooms are located on the floor below and to the rear of the furnaces. The furnace transformers have a capacity of 1,500 kv.-a. and connection is made to the furnace catenaries by means of the usual copper busses. The secondary is connected up in delta while the primary is in star. Current is obtained from the company substation at 13,200 volts by means of underground cables.

An interesting feature of the Volta furnace is seen in the electrode arrangement. The electrode clamps on a furnace of this size are usually water-cooled, and in most types of furnaces water pipes as well as copper leads have to be carried by the electrode hoisting arrangement. This has been done away with in the present instance and copper tubes serve to conduct both the current and water. Two tubes are employed for each electrode, and while both serve to conduct current, one serves as a water-feed while the other is used as a return.

In heavy current engineering the question of skin effect is of much importance; the current tends to crowd to the outside of any conducting member while the interior is of little or no use. By using a tube and utilizing the bore for water the economy effected is at once apparent. The electrodes themselves are of a patented design which allows the use of electrodes of varying diameter.

6-TON VOLTA FURNACE IN RUNNING POSITION.

The tilting arrangement is also of some interest. It is not of the rocker type but a heavy shaft is employed, placed well forward towards the front of the furnace. The furnace is so arranged and balanced that a comparatively small-sized motor is all that is necessary to give the desired tilt.

The Thury regulator of an improved design developed by the Volta Manufacturing Co. is employed. They are equipped with no-voltage devices which prevent the travelling of the electrodes downward under the action of the regulator in the event of power failure. In place of the carbon arcing types employed in regulators of former design, copper contacts fitted with magnetic blow-out coils are now used.

The two furnaces now installed make possible six heats a day, with an aggregate production of from 80 to 100 tons.

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PRINCIPAL CONTENTS

The Outlook For 1920

IT is not necessary that a person should resort to soap box oratory to make it plain that there is going to be good business done in Canada during the present year.

The one thing that at present is holding up more rapid development is the inability of many firms to secure the equipment they need. The lines wanted are oversold, and production cannot keep pace with the demand, which is insistent and financially sound.

The price of the equipment is not now the determining factor. This fact alone makes it plain that those putting in the machinery have a good working knowledge of what they are going to do, and are satisfied that they see a market for their product big enough and extensive enough to easily discount any increase they may have to pay for the equipment they need.

Steel can be accepted as the barometer for the metal trades. The bookings of steel for this year are large—very large, and they come from such a wide variety of interests that it is apparent that activity is going to be widespread. Shipbuilding, structural workers, automobile builders, boiler and engine firms, agricultural implement shops, and scores of other lines are in the market for material.

Representatives of these concerns state that their big problem is not one of selling, but of producing. They are making things that the people want in order to increase the production from the land. They are making it possible for us to have more for sale than we have had in the past, and in this fact lies our best chance for righting the exchange that is telling so forcibly against our coinage in the United States market at the present time.

It is hard to see where there is going to be a slump in prices for some time to come. Indications are not that way. Those who have stayed out of the market waiting for a lower level have been disappointed, and it is hard to see where such a course can be justified in the light of the volume of business that is now piled up against the producing capacity of the steel mills, the machine tool works and other kindred lines both in United States and Canada.

Given freedom from labor troubles, and an honest attempt on the part of the manufacturers to put real merit into their product and real foresight into their sales programmes, Canadian industries should go ahead in 1920 as they have never done in a similar space of time.

Get Straight For 1920

START the new year by getting your books in good shape. It does not make any difference whether you have an elaborate set of books, or only the little book that the savings department of the corner bank gives to you.

If you have accounts outstanding collect them.

If you have bills to pay, get out and pay them off.

Don't resort to the poor expedient of financing on money that you honorably owe to other people.

If you cannot pay off your debts now the chances are that you will not be able to pay them off in the future.

If you cannot collect your accounts now, in these days of free circulation of money, the chances are that you will have trouble in realizing on them in the future.

Get your house in shape for a clean year as far as credits and debits are concerned. Don't pigeon-hole accounts that you know you owe and ought to pay. It hurts your feelings a whole heap more to pay for something after you have used it than before. For instance, you can see the reason and wisdom for paying for coal now. In the spring the straightening out of such an account would be accompanied by a wry face and a grouch.

Remember the man you buy from cannot finance on promises any more than you can.

Have your business in good shape, if it is nothing more than your household affairs, then no matter what comes, you will not be found running for cover at the first sign of a setback.

The Granary and the Workshop

POLITICIANS used to refer to Canada as the Granary of the Empire, and no doubt that is a reputation worth the having.

At the same time Canada is making rapid strides toward becoming one of the great workshops of the Empire. Developments are under way in the matter of increasing the steel producing capacity of this country that can hardly be grasped by the ordinary citizen. The plans have the backing of all necessary money, and they are not on a small scale, either. The work is being undertaken with the idea that there is a great future ahead of this country.

The way in which American branches are coming across indicates that these people have a tremendous amount of faith in this country, and in the ability of the mechanics of this country to make an article that can compete in the markets of the world.

The Canadian is a good mechanic if he has a chance. He can think and he can plan, and he can hold up his end in the matter of turning out the quantity.

Canada is demonstrating that it can be not only the granary of the Empire, but the workshop as well. Agriculture, from the size and extent of our country, should be our basic industry. It is a sure foundation from which to grow. But the industrial section of the Dominion is coming to a point where it is going to crowd closely on the heels of the supremacy of the farmer. Together, these make a great combination.

WHAT THINGS ARE DONE IN NAME OF SAFETY!

Devices Grow and Thrive in This Rare Atmosphere—and What Will Be Coming Out Next?

Editor, CANADIAN MACHINERY:—The pursuit of safety methods is laudable. As an ameliorator of industrial conditions it ranks highly, and the literature diffused so liberally by the High Priests of Safety First add greatly to the gayety of the race. However, like many other good things, it can be overdone, and on some of its devotees it reacts in strange fashion. Looking through the pages of a technical magazine recently, we came across a section headed: "Platitudes for Puzzled Practitioners." This was not the exact wording, but it indicates the meaning. After reading of a bright individual who conceived the idea of putting a fixed obstacle on a lever to prevent a sliding piece sliding too far, we were going to try another section, when a spirited sketch attracted our eye. It showed a hand grasping a cold chisel, and another hand poising a hammer as though to strike. There was nothing in this to cause comment, but on both the hammer and chisel were depicted strange protuberances. That on the chisel was arranged near the end, and looked as though some lady mechanic had tied a ruff round its neck to make it look better. The hammer was decorated right on the end of the shaft, and close examination revealed the fact that the excrescence was an ordinary round washer held on with a coach screw. Now for many years we have used a hammer and chisel, but never saw them fitted up in this manner. Therefore, we anxiously read the text, to find out the raison d'être of such a peculiarity.

It appears that a sturdy mechanic grasped his trusty hammer, and prepared to smite the chisel a resounding blow. Alas, the hand that grasped the hammer was a greasy hand, and instead of striking the chisel, the smooth hammer shaft slid through the greasy grip, and smote an unoffending laborer on the apex of the cranium. Nothing daunted, the mechanic grasped the hammer again and this time his hold was so firm, and his aim so true, that the chisel drove through the metal, slipped through the holder's hand, and hit a second workman who happened to be adjacent. This was too much. Safety First was outraged, and the safety expert called in. One glance sufficed, and the remedy was determined on in a twinkling. Simply fasten a large washer on the chisel, above the hand, and a similar one on the hammer, below the hand, and the trick was done. Oh, safety, what things are done in thy name! For the benefit of those who are interested, we offer some further suggestions:—An inspector should be appointed who will periodically inspect the men's hands, and see that all superfluous grease is removed. Lessons should be given twice a day on the proper way to hold a hammer and chisel. To make absolutely sure, any man engaged in chipping should be enclosed in a boiler plate compartment. Men operating lathes shall be provided with a suit of mail and asbestos gloves in case of being burnt with flying chips. Men engaged in grinding operations shall be located in another room, and watch the operation through a periscope. We might go further, but have fear of being mistaken for a safety expert.

Safety first is an excellent motto, but should be attended with a little common sense.

Progress in Marine Power

SINCE the day when the old paddle and sailing vessel "Savannah" crossed the Atlantic, ships and ships' propulsion have gone through a constant process of evolution. The first great change was the introduction of the screw propeller, to replace the paddle. This in turn brought about modification of the engine, and many and various were the expedients adopted. The trunk engine, the return connecting rod, the geared engine, in which the propeller was geared up instead of down, as regards revolutions, all had their day. The inverted vertical type then made its appearance, and speedily gained favor. In its early days it was a single crank engine, with a huge fly-wheel, and some of these steamers were running from Antwerp to the far East as late as 1906. They belonged to the famous Blue Funnel line of Alfred Holt & Co., Liverpool. Pressures were low, from 15 lbs. to 25 lbs. per square inch. With more knowledge of metallurgy, and better manufacturing facilities, higher pressures came into vogue, and the compound expansion engine appeared. The advantages of this type were so marked that a further development was soon made, and triple expansion was adopted. This seemed to mark the limit, for although quadruple expansion was adopted in some large ships, the triple expansion became the main marine prime mover. However, the marine engineer never feels content with any achievement, and it was not many years before the Hon. Chas. Parsons adapted the steam turbine to marine propulsion. marking the greatest innovation since the days of Fulton. About the same time Dr. Diesel's oil engine was being adapted to marine work. The steam turbine rapidly came into favor for high-powered, fast vessels, but was unsuitable for the ordinary steamer. This was on account of the efficient speed of the turbine being too high for the efficient working of the propeller in the ordinary slow vessel. This seemed to limit the usefulness of the turbine, till the inventor of the turbine tried out a reduction gear between turbine and propeller. It proved successful, and was further developed, double reduction gears being used, till now the largest and fastest vessels in the world use this type of prime movers. The oil engine, backward for a long time as a marine proposition, has been rapidly developed in the last four or five years, till now it is taking its place as a competitor of both turbine and steam reciprocator. Future development will no doubt result in the supremacy of either the geared turbine or the oil engine, with the gradual disappearance of the reciprocating steam engine.

COMPANY IS REORGANIZED

ANNOUNCEMENT is made this week of the reorganization of the Garlock-Walker Machinery Co., Limited, which will, in the future, be known as Garlock-Walker Machinery, Limited. A Dominion charter on fairly broad lines has been secured, and the capital of the company increased from $50,000 to $500,000. Of this amount $250,000 will be issued, the balance remaining in the treasury for future development.

WM. GARLOCK, JR., Pres. Garlock-Walker.

The firm has secured a long-term lease on the Mill Building, of the Toronto Furniture Co., on Dufferin St., which has a floor space of 16,000 feet. The repairing and rebuilding work carried on by the firm will be done at the new premises. On this account Garlock-Walker Machinery are giving up the warehouse and shop on Adelaide Street, as well as the warehouse on the Don. At the new warehouse and works the firm intend to carry considerable machinery in stock.

There has been no change made in the personnel of the company; they remain as follows: President and general manager, Wm. Garlock, Jr.; vice-president, A. B. Walker, and secretary-treasurer, J. Albert Brown.


ILLINOIS
HOBS
NONE BETTER CAN BE MADE
It is not our ambition to make all the Hobs used in industry; only to make the best.
ILLINOIS TOOL WORKS, CHICAGO.

MARKET DEVELOPMENTS

Better Deliveries Are Much Wanted Now

Capacity is About 80 Per Cent. Now, But Against This There Are Bookings for About 150 Per Cent. of the Nominal Output—Bar Iron Prices Are Up This Week

IF a vote were taken at the start of the 1920 business year of the machine tool and steel trade, as to the one thing most to be desired just now, the verdict would no doubt be "Better Deliveries."

Authorities of the United States Steel Corporation state that production at their plants is now 80 per cent. normal, although the strike there has never been officially declared off. That is very encouraging, but the trade faces a deficit of a good month's output by reason of the strike. It is safe to say that against the 80 per cent. production, there is now a demand equal to 150 per cent. of normal, so there is still a large gap left.

Bar material moved up in Canadian points during the week. Mill prices in most cases work out around 3.80 Toronto, against a former 3.30, and warehouses have left the 4.25 price that has remained for a good many months and gone to a 4.75 level. Mills are sold out on all wanted lines, and although more finishing capacity is coming in shortly, this will simply tend to make more demands upon the already rushed open-hearth capacity.

Business is coming to the market from many sources, such as shipyards, agricultural implement firms, automobile factories, while large tonnages of structurals have been carried over from 1919.

Prices for machinery and small tools remain about the same. Large quantities of used machinery are coming into the market, from the winding up of the shops that carried war contracts.

English makers of small tools are cutting the price pretty close in order to secure business from some of the large firms, but as a general thing there is not much price shading being done at present in machine tools or supplies.

BUSINESS GETS AWAY TO A GOOD START IN MONTREAL THIS YEAR

Special to CANADIAN MACHINERY.

MONTREAL, Jan. 8.—The slight disarrangement in the general market, caused by the holiday season, is gradually being adjusted and conditions are taking on a more normal appearance. The spirit of optimism marks the advent of the new year and dealers are anticipating a good business year in 1920. The realization that existing conditions are likely to prevail for an extended period has impressed many with the immediate need of a more progressive plan of reconstruction than was shown during the past year.

The state of industrial unrest that has been so pronounced during the past six months is slowly taking on a more settled condition, and this will help to bring about an adjustment that will enable business to become more stabilized.

Despite the fact that the first post-war year has gone by, the industrial world is apparently operating under war conditions, the domestic peace demands being such that the production is still insufficient to meet the trade requirements. This is particularly true in respect to some lines of finished steel, the market for which is far beyond the present capacity of the mills. The filled-up condition of many of the large mills makes the delivery question one of marked uncertainty. Machinery inquiries are exceptionally good, and the prospects in this direction look bright for the early part of this year. The scrap situation has developed little of interest, and apart from the firmness in steels the market is uneventful.

Steady Demand For Tools

There is a well-distributed inquiry for a wide range of machine tools and general supplies, and a large portion of this comes from the Middle West. Farm demands are quite heavy. Railroad requirements are falling off a little, but dealers are still reporting considerable business of a light and varied character. Second-hand tool business is quite active, as a result of the delayed delivery on some American lines. There is every reason to believe that prices on tools and supplies will be subject to advances in the near future.

Brighter Future For Scrap

While there is a prospect of an early revival of scrap activity, there is little to indicate that a move of this kind has, as yet, developed. Inquiries, however, are more promising and dealers are hopeful for the coming months. Irons are comparatively firm and may be stronger in a short time. Non-ferrous metals are inclined to be weak, but current quotations are unchanged.

BETTER DELIVERY THE WISH OF 1920

Otherwise Outlook is Bright for the Industrial Outlook in This Year's Trade

TORONTO.—The start of another year's trading is well under way, with prospects all that could be desired. It may be well to modify that phrase "all that could be desired" by a little explanation. If one were to go to the steel trade or to the machine-tool trade and ask what would help them more than anything in the present year, or especially in the immediate future, the chances are that the verdict could be summed up in a couple of words, viz.: "Better deliveries."

There is such an expansion of business on all hands that the makers of tools cannot get out the orders. As a matter of fact production per man in the shops

of the tool builders is not as high as it was before the war.

Buying is General

One of the largest dealers in steel in this district showed CANADIAN MACHINERY a list of business that was carried over from 1919 to 1920 on his books. It was not chance trade, or orders that might be withdrawn, but all placed on the understanding that a contract is a contract. The tonnage was large and the industries represented were representative of almost every line in the country. They took in shipyards, automobile shops, agricultural implement works, boiler makers, and a number of other lines. Besides this there was a large booking of structurals, all of which means good business in this country during the year that has just been entered upon.

Indications that are coming up now bear out the prediction that has been made in these pages recently, viz., that prices of certain lines of steel would move upward. This week some of the Canadian mills moved bars up. The Toronto price from the mills has been raised from 3.30 to 3.50, which means that the warehouses will in all likelihood be quoting bars, iron or steel at 4.75, a figure which CANADIAN MACHINERY is quoting this week for the first time as the average price to the buyer who gets his materials from the warehouse. The former price of 4.25 has stood for a long time, but had to give way in view of the recent action of the mills.

"We are doing the best we can for our old customers," is the way one importer sized up the situation. "Judge Gary says that the mills of the corporation are running about 80 per cent. That is very good," he concluded, "but it must be remembered that against this 80 per cent. production there is a demand that looks like 150 per cent. of normal."

Good Business Reported

In last week's CANADIAN MACHINERY reference was made to the fact that one buyer who had a large order to place for cutters and drills was looking for a special price. From what CANADIAN MACHINERY can learn he was successful in his quest for part of the business, getting some sag in the price. Most of the representatives of Canadian concerns are standing pat on their prices for small tools, and they are getting good business.

POINTS IN WEEK'S MARKETING NOTES

New York reports state that dealers look forward to 1920 as the best year in their machine-tool business.

Belgian buyers in the U. S. market have a long list of requirements so large that even the U.S. war stock cannot fill the list.

The prices of steel and iron bars have been advanced, and warehouses here are now quoting 4.75 base, against a price of 4.25 which has held for a good many months.

The production capacity now in operation at the Steel Corporation plants is stated to be about 80 per cent. Against this there is a demand that would represent about 150 per cent. of normal.

There is going to be more finishing capacity in the steel trade, but that does not affect the tonnage of steel. The blast furnace and the open hearths are the real pace setters.

Large orders at the steel mills are looked for when the U. S. railroads are returned to their owners. It is hoped that the mills can catch up with their business before that takes place.

There is a demand in this district for foundries that can handle castings for certain lines of machinery.

Wire nail prices at the mills are going up. Fancy prices are being paid for nails shipped from stock for instant delivery.

Premiums for sheets at U.S. points are ranging around $10 per ton up, according to the urgency of the sale.

Shops that were a long time tooling up for new lines are getting up their production rate, and with this it is to be expected that there will be a greater demand for small tools.

1920 TO BE THE BEST YEAR THE MACHINERY TRADE HAS EVER HAD

Special to CANADIAN MACHINERY.

NEW YORK, Jan. 8.—The year starts out promisingly for the machine-tool trade. While there has been something of a lull over the holiday period, it has by no means been as quiet as has been the rule in past years. December was an excellent month and rounded out a very good year for the entire trade. Many of the machine-tool manufacturing companies are holding meetings this week of their sales representatives. To say that there is optimism in the trade is putting it mildly. Some go so far as to predict that 1920 will be the best year the machine-tool trade has ever experienced. While it appears like plain sailing, there is in some quarters a degree of apprehension over the price situation. Labor troubles seem to be fairly well out of the way, but there is a fear that advancing prices, not only of the ordinary necessities of life, but of all articles, may eventually cause some hesitation on the part of buyers. Certainly there cannot be the greatest degree of prosperity until production reaches somewhere near a normal basis.

During the past week the General Electric Co., Schenectady, N.Y., has continued to buy for its new plants and for replacements. The E. W. Bliss Co., Brooklyn, has again come into the market for milling machines and boring mills and will have some planers to buy. Other purchasers include the Bantam Ball Bearing Co., Bantam, Conn.; the Redington Standard Fittings Co., Redington, Pa.; the Farrel Foundry & Machine Co., Ansonia, Conn., and the Newport News Dry Dock & Shipbuilding Co., Newport News, Va.

The Rolls-Royce Co. of America has issued a new list of about fifty tools to round out the equipment for its new American plant at Springfield, Mass.

A Belgian mission, headed by M. Jean Jean, and representing the Societe la Construction de Metallique, of Brussels, is in this country to select a large number of machine tools from the surplus stocks of the United States Government. The mission brought lists of tools desired by Belgian manufacturers, but could not find more than 600 of these tools in the stock held by the Government. Efforts are being made to purchase the remainder of the needed tools, numbering several hundred, from other sources.

ANNUAL BONUS BY GEAR SHAPER CO.

Custom Was Inaugurated in 1916 And This Year Called for Sum of $25,000

Following a custom inaugurated in 1916, the Fellows Gear Shaper Company on December 24th distributed an annual cash bonus to its employees. Approximately 665 employees received this bonus, which amounted to a total of $25,000, $20,000 of this amount being paid in gold.

The rating of this bonus is governed by the length of continuous employment, and is based on the total wages earned during the year. For the first and second years it is 2 per cent. of the total wages earned, and increases by 1 per cent. each succeeding calendar year up to 10 per cent.

The bonus distribution this year was of special interest to those who were in the "service" during the World War. To all of those who returned to the employ of this company the bonus was calculated from the time of their original employment. That is to say, when they returned they were not considered as new employees, and the time spent in the service of "Uncle Sam" was not deducted.

Effective January 1, 1920, Lieut.-Col. B. Ripley, Toronto, was appointed district engineer of the C. P. R., succeeding Mr. A. L. Hertzberg, retired.

CANADA'S PREMIER MACHINERY HOUSE

MR. H. W. PETRIE, SR.

THROUGH half a century of industrial expansion, through wars and rumors of wars, through financial panics and trade depressions, the H. W. Petrie Limited, has stood, and stands to-day in unchallenged supremacy, the acknowledged machinery headquarters for Canada—the firm with a national reputation for quality, service and fair dealing.

The policy of Efficiency in Service is one of the sterling qualities that have built up and sustained the public confidence in the H. W. Petrie Limited, for fifty years.

In Toronto alone we possess 130,000 square feet of floor space for the storage of modern machinery. This, and the excellence of our buying and selling connections, enables us to handle a contract of **any** size in the quickest possible time and at most reasonable prices.

Our facilities for repair work of every description (stationary and marine) are magnificent.

H. W. PETRIE LIMITED

TORONTO

NOT MUCH PROSPECT OF CATCHING UP WITH THE SHORTAGE OF STEEL

Special to CANADIAN MACHINERY.

PITTSBURGH, Jan. 8.—Activity in the search for prompt lots of steel products is increased, as compared with conditions prior to the holidays, while on the other hand there is little business being done for extended deliveries. The decline in the volume of contract business is a necessity of the situation, since the mills that were willing to accept contracts are filled for such periods as they were willing to consider, the half year in some cases, and the first quarter only in other cases. Thus there is practically no opportunity to place open contracts.

The shortage in steel is not relieved, nor is there any prospect that it will be relieved in the near future. There is even a question whether it ever will be relieved as long as the period of industrial prosperity continues. The common view is that conditions will be approximately back to normal in a period of months, six months being the longest term usually mentioned.

While this six-months-to-normal is a common view in the trade, there is some ground for disputing it. There are two considerations: First, that production is likely to increase sharply in the next few weeks, and, indeed, if production does not, the steel industry will be in a bad way, for it has always made its good profits when it was operating on practically full tonnages. Second, railroad buying on a fair-sized scale at least is expected almost as soon as the railroads are returned to their owners, the date for that operation being March 1, while the approach or advent of spring is likely to bring heavy demands for steel for construction purposes. Hence, it would seem that if the steel mills do not catch up with their customers' requirements in the first three or four months of the year, they will have little opportunity to do so later.

It is easy to over-rate the so-called "shortage" in steel by comparison with capacity. While the market demand for spot and prompt lots is insistent, it is generally for carloads to 1,000 tons, and thus a few hundred thousand tons would be a large aggregate. That, however, is not much when viewed in the light of production or capacity figures. At the time the iron and steel strike started, September 22, there were at least normal stocks of steel in the hands of jobbers and manufacturing consumers, and probably somewhat greater stocks than usual, as the strike certainly had been expected by many, both sellers and buyers. Production of finished rolled steel just before the strike was at the rate of about 600,000 gross tons a week. In the 15 weeks intervening, production has averaged about 400,000 tons a week. The present rate is probably 550,000 or 575,000 tons a week, while capacity is about 725,000 tons a week. Buyers got along somehow when they were restricted for 15 weeks to an average of 400,000 tons a week, and a shortage of a few hundred thousand tons if the mills, during the next two or three months, work up to 650,000 or 725,000 tons a week.

Fancy Prices Paid

The lowest price on wire nails for quick shipment seems to be $4.50, base, per keg. Just before the strike the independents were on their $3.50 basis, while the American Steel & Wire Company has continued its price at the March 21 level of $3.25. The $4.50 price is made by some large mills, rather than by small producers or by middle interests. Nails purchased from stock may bring dollars per keg more. Merchant steel bars show a great range. The March 21 price, adhered to by the Steel Corporation and some independents, is 2.35c, while some large mills quote 2.50c and can make delivery in two or three months, and some rolling mills, including iron mills, producing from purchased billets, ask and secure 3.00c and higher, for delivery, say, in 30 days. In limited tonnages one can frequently buy at 3.25c from warehouse, particularly warehouses maintained by mills that have a price of 2.35c to 2.50c for mill delivery, time uncertain. In sheets, which, by the March 21 schedule, are set at 3.55c for blue annealed, 4.35c for black, and 5.70c for galvanized; premiums on deliveries over the first quarter are usually about $10 a ton, but black sheets from stock command from 5c to 6c.

Stabilization Policy Firm

The United States Steel Corporation's adherence to the March 21 price schedule has been reaffirmed and thus is booked for indefinite continuance. There was possibly a little room for doubt recently whether the policy would be contained after 1919, for the basis was the March 21 arrangement between the Industrial Board and the steel producers, and all that was settled upon at the time (irrespective of the fact that not long afterwards the Industrial Board disappeared) was that prices were to be "stabilized" for the remainder of 1919.

The reaffirmation comes by way of a public statement made by Judge Gary, chairman of the Steel Corporation, declaring the corporation's adherence to the schedule and its feeling that steel price advances would tend to encourage further increases in the cost of living. Thus the policy is to be of indefinite duration, and as the statement makes no reference to time, or to a new calendar year having come, there is no admission that at any time the Steel Corporation regarded its policy as one adopted for 1919 alone.

The higher prices being paid by many buyers of steel, accepted by the majority, if not nearly all of the smaller independents and by a few of the large independents, must thus be considered a premium price above the market basis, the premium being paid for the early delivery involved. There are relatively few cases of premiums being paid for second quarter, and none involving third quarter.

Pig Iron

Pig iron advanced an average of about $11 a ton from June 1 to just before Christmas, when advances practically ceased, the market having been relatively dull since then. Some furnace interests now talk as if the advancing movement is to be renewed. Undoubtedly pig consumers have it in their power to put the market up further on themselves if they desire, and perhaps they will do so. There does not seem to be altogether good ground for an additional advance at this time, if, indeed, the previous advance was entirely justified. The furnaces are either back into blast or are scheduled to get into blast. On the March 21 prices some furnaces claimed they could not make a profit, but prices $10 a ton higher are a different matter. A $10 clear profit would easily pay in one year for the best furnace built. There is much talk of labor shortage and labor inefficiency, but if such conditions continue, the influence will be to make pig iron plentiful, rather than scarce. About 80 per cent. of the pig iron made is used by steel works, nearly all the balance going to iron foundries. Labor shortage and labor inefficiency would restrict the operation of steel mills, and hence their consumption of pig iron. With a blast furnace, however, it is chiefly a question of the raw materials being dumped in and of the superintendent having the requisite ability to operate the furnace.

OBITUARY

The death is announced from Cleveland of a well-known citizen of St. Catharines, Mr. Ralph B. Hamilton. Mr. Hamilton, who was for twenty years manager of the Packard Electric Company in St. Catharines, was 44 years of age and a graduate of Cornell University. He was born in Toledo. He was president of the Carey Safe Company, Buffalo; Packard Fuse Company, Canadian Standard Products Company, and Precision Manufacturing Company, all of St. Catharines. He went to Cleveland three months ago to become production manager of the National Safe Company, of which he was vice-president.

Belgium to Buy Locomotives.—Belgium, which is badly in need of locomotives, is about to place a contract with the Montreal Locomotive Works. The Belgian Government recently placed an order for 100 locomotives with Armstrong, Whitworth Company in England. There is a possibility of orders for cars being placed in Canada also.

"...... not worth the paper they are written on"

We refer to Production Cost Figures that depend on pencil records.

What pencil records?

The time-cards on job work that your workmen or foremen now fill out in pencil.

Why aren't they good in pencil?

Because pencil records can be changed and a working-time balance can be forced.

And if your factory production costs are "leaky" the whole question of your costs, your overhead, etc., is "up in the air."

The International Job Recorder absolutely corrects this condition. It enforces a printed, machine-made, unchangeable, infallibly accurate record of the time spent on any job or operation.

International Job Recorder
"Made in Canada"

It does many other profitable things for its users.
Let us tell you more about them.

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Head Office and Factory:
300 Campbell Ave., Toronto

Also at - Montreal
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(Also makers of Dayton Computing Scales and Hollerith Electric Tabulators)

IRON AND STEEL TRADE IN 1919

THE war restrictions which surrounded the American and Canadian iron and steel industry during 1918 were happily removed, and during 1919 the market has been left free to work out its own salvation. The effort of the more prominent producers to co-operate with other forces towards reducing the cost of living showed itself in a reduction of prices, first, at the beginning of the year, and, secondly, in March last, when prices were established at levels $10 to $15 per ton below those authorized during the war by the U.S. Administration. This conservative policy has been firmly maintained, and steel products have the distinction of being one, if not the only one, of the basic commodities obtainable at values considerably under those ruling at the conclusion of the war.

While demand was fairly well maintained during the first quarter, timidity on the part of buyers was apparent over the following three months, due largely to the difference between the views of the steel producers and the U.S. Administration on the question of rail prices. An indifferent demand with rather weakening prices during the early summer months was followed by a gradual rising volume of business and increase of production, but with no appreciable price changes. This was the position when the American steel strike started on 22nd September, to be followed by the coal strike at the beginning of November. The effect of a sharp curtailment of mill and furnace operations was immediately apparent. There was a scramble among buyers to be covered for their requirements during the first six months of 1920, and between October 1st and the end of the year prices on pig iron and steel products were advanced as much as $10 per ton. As matters stand to-day, the American mills are carrying over to 1920 the equivalent of the loss of eight to twelve weeks' output, caused by the strikes. Not only so, but a very active demand for all steel products has arisen in the interval. The prospects are that for the next few months deliveries will be difficult to obtain, and that the present increased level of prices will be fully maintained.

The adverse exchange situation with the United States is one of the striking features of the year. While benefiting certain industries in Canada which have the advantage of an excellent market in the States, it cannot be said to be altogether an unmixed blessing to the Canadian steel manufacturers. While they are in a position to take advantage of the situation by advancing their prices, should they care to do so, this advantage is partially offset by their dependence on the United States for much of the essential raw materials. Until the international exchange situation clears, it is likely that American exchange will continue to operate against Canada, and this will have the tendency to restrict purchases.

Reports recently received from Germany indicate that it will be some years yet before the steel industry in that country can reach the position it occupied prior to the war. As regards export trade, Germany can be left out of the reckoning for the present year.

Notwithstanding the low rate of sterling exchange, it is expected that only trifling quantities of British iron and steel products will find their way into Canada for some time to come. Prices in Great Britain remain at a high level. Production, however, is below the average, and cannot cope with the demand.

In a general way, the experiences of 1919 have been marked by some disappointments, but at the same time, have served to reveal the unsound movements in the new era of reconstruction. The tendency, therefore, will be towards more settled conditions in all branches of labor, as the common-sense of the community is beginning to assert itself in no uncertain way, and it is becoming increasingly evident that no extreme element in any industry will be allowed to control the situation, or deprive the vast general public of their necessities.

With the gradual settlement of these labor troubles, the outlook will be for lower prices in all commodities, but this can scarcely come in the steel trade until the huge productive capacity of the mills in the United States can catch up with the demand, and this, at best, will be a matter of some months. During the first half of the present year, therefore, it will be a matter for Canadian users of steel products to anticipate their requirements, and to bring all possible pressure on the mills to secure deliveries.

We can well bear in mind the words used in the days of Good Queen Bess: "Let us carry with us ears and eyes for the times, and hearts for the events."

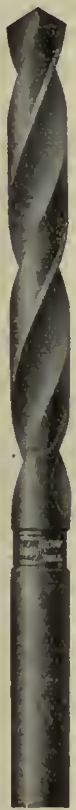
J. T. McCALL,
President and General Manager,
Drummond, McCall & Company, Limited.

January 5th, 1920.

Announcement !!

MORROWS AT INGERSOLL

The pioneers at Twist Drill making in Canada, who always made—not cheap drills—but *good drills,* have now perfected something better, a *Twist Drill of really wonderful performance.*



A demonstrator—an expert on Drill Tempering—will go into your plant if desired to show you, without cost to you, what these *Morrow High Speed Twist Drills will do.* If you are trying for maximum production on rough work, write us at once.

If these Morrow High Speed Drills will do for you what they are doing in some of the large auto manufacturing plants *then* you want them.

Morrow High Speed Drills will positively give you *more holes* than you can get with other makes.

JOHN MORROW SCREW & NUT CO., LIMITED

INGERSOLL -- -- CANADA

STRENUOUS WORK FOR TOWING MACHINES

CONTINUED demand for Canadian-made marine equipment is indicated in reports from manufacturers of towing machines, cargo winches, deck hoists, steering apparatus, etc., and very much of this machinery is being employed in strenuous spheres of usefulness. The Corbet Foundry & Machine Co., Owen Sound, state that the Government wrecking tug, the "Lord Strathcona," which is equipped with one of their No. 5 towing machines, has been engaged recently on heavy service in connection with the several groundings and wrecks on the Atlantic coast. For the time being the tug's headquarters have been shifted to Halifax. The G. T. P. tug "Lorne, equipped with Corbet machines, is the largest on the Pacific coast, while the "Strathcona" is the largest on the Atlantic coast. The tug "Lucknow," of the Midland Transportation Co., also having Corbet equipment, is the largest tug on the Great Lakes.

As indicating the service that her Canadian-made equipment is performing, the Corbet people recently received a letter from a large Buffalo shipbuilding concern, stating that five of the six automatic steam-towing machines have been placed in U. S. navy tugs. These machines all passed the preliminary trials. The first tug has been in commission all summer, towing barges from Chicago to Buffalo, and has met all requirements. The other tugs have escorted Eagle boats from Buffalo to New York over the St. Lawrence route. The automatic release and take-up possible by use of the Corbet machines means a practical economy in the application of power to towage, there being no pulling and hauling and jerking, as is the case when the automatic take-up is lacking. Some thirty of these machines are in use on the Pacific coast. Many others to the Atlantic, and not a few have been supplied to foreign buyers.

GOING IN FOR EXPORT BUSINESS

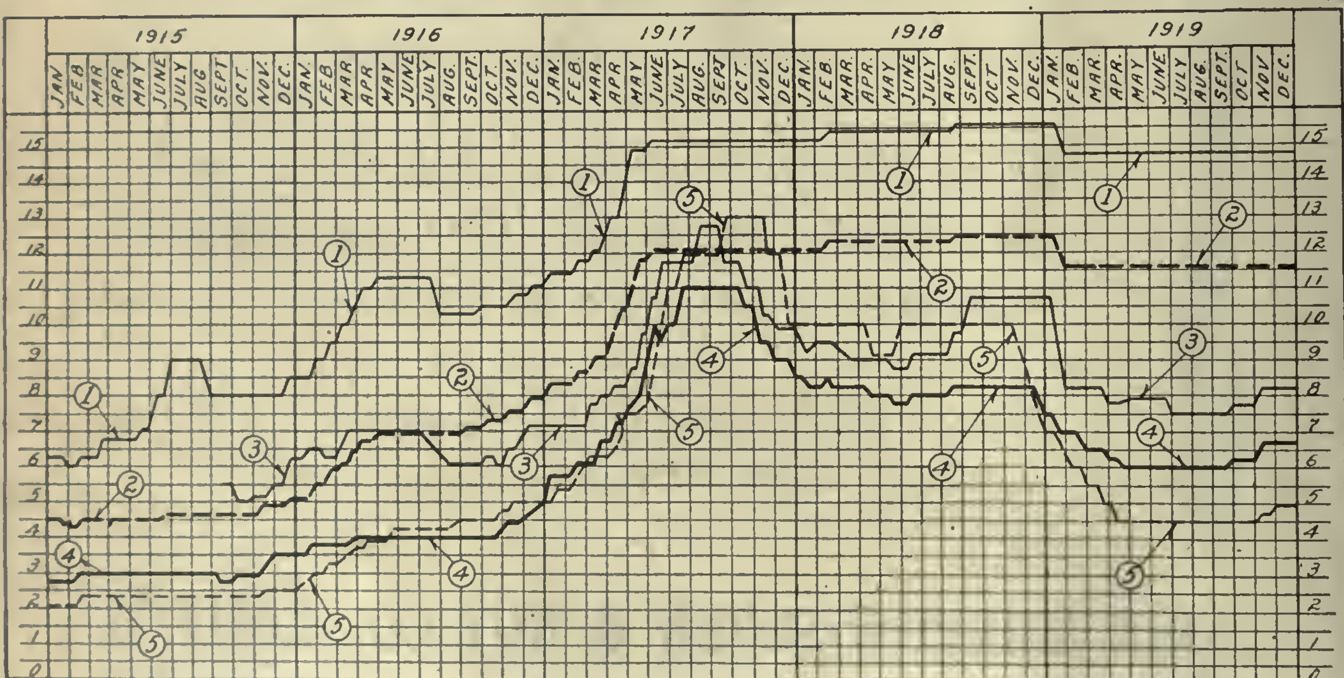
Took Advice of Trade Agent and Sent Their Own Man to Investigate Conditions

During the past year the old-established firm of T. McAvity & Sons, Ltd., of St. John, N.B., has been at work in what is probably the best export fields for Canadian manufacturers: Britain, Australia and France, and have made many additions, alterations and improvements to their several plants to enable them to compete successfully in these places with the many other makers of products in their line.

As no doubt every exporting manufacturer knows, it is a different proposition now than was selling the foreign trade before the World War, with trade conditions altered, exchange rates to be considered, and manufacturers everywhere seeking bigger markets for their goods, and while in some cases "before-the-war" trade connections can be re-established, it is mostly a case of go over the ground again. Exchange is by no means a small item to be considered as it affects the exporters to low-rated countries adversely. A pound in English currency, if spent in England will, of course, purchase more than the same money sent over to Canada in payment for Canadian goods, and therefore the Canadian article, although nominally of the same value as the English, will be higher in price when taken into that country.

Early in the game Messrs. McAvity took the advice given by the Canadian Trade Commission, of having a man right on the ground, and this policy has proved to be the only practical one to be followed. Lieut.-Col. T. Malcolm McAvity, upon his return from France, made his headquarters in London, Eng., and from there has been opening up an extensive and promising export business both in Britain and on the Continent, and he will take charge of the branch office and warehouse there which the firm intends opening shortly where they will carry a large stock of their manufactured material.

Price Fluctuation During the Years 1915-1919



Prices	1-1" Bl. Wld Gal Pipe \$ Per 100 Ft	2-1" Bt. Wld Bl Pipe \$ Per 100 Ft	3-Premier Sheets \$ Per 100 lbs	4-Black Sheets \$ Per 100 lbs	5-Boiler Plates Cts Per lb.
Pre-War	6.25	4.45	5.50	2.75	2½ ¢
Record High	15.56	12.41	12.75	11.00	13 ¢
Lowest 1919	14.71	11.56	7.50	6.00	4½ ¢

The Week's Events in Montreal Industry

The Hellenic State Trade Commission, Drummond Bldg., Montreal, have an inquiry from Greece for small oil engine and water distributing units manufactured in this country.

The Davie Shipbuilding plant at Lauzon, Quebec, which has been practically closed for some weeks, has been acquired by the Canada Steamships Lines and building operations will be resumed shortly, when about 1,500 men will be employed to carry out new contracts which have recently been closed.

The Montreal Motor Show, which will be held the week of January 17-24 at the Motordrome, promises to eclipse any that have been held in previous years. Over one hundred makers of cars and accessories will be represented, and excellent accommodation has been provided for every exhibitor. Special lighting and decoration has been made to add beauty to the display.

The fate of the steamer "Canadian Recruit" and the serious position of another of the merchant fleet in the icy passage of the lower St. Lawrence, has drawn the attention of the Government to the imperative need of providing adequate facilities for the protection of such vessels as may be late in getting away at the close of the season. The Hon. C. C. Ballantyne, Minister of Marine and Fisheries, has expressed his belief that it may be necessary to provide equipment in the way of ice-breakers, that will assist navigation on the St. Lawrence after ice conditions become severe.

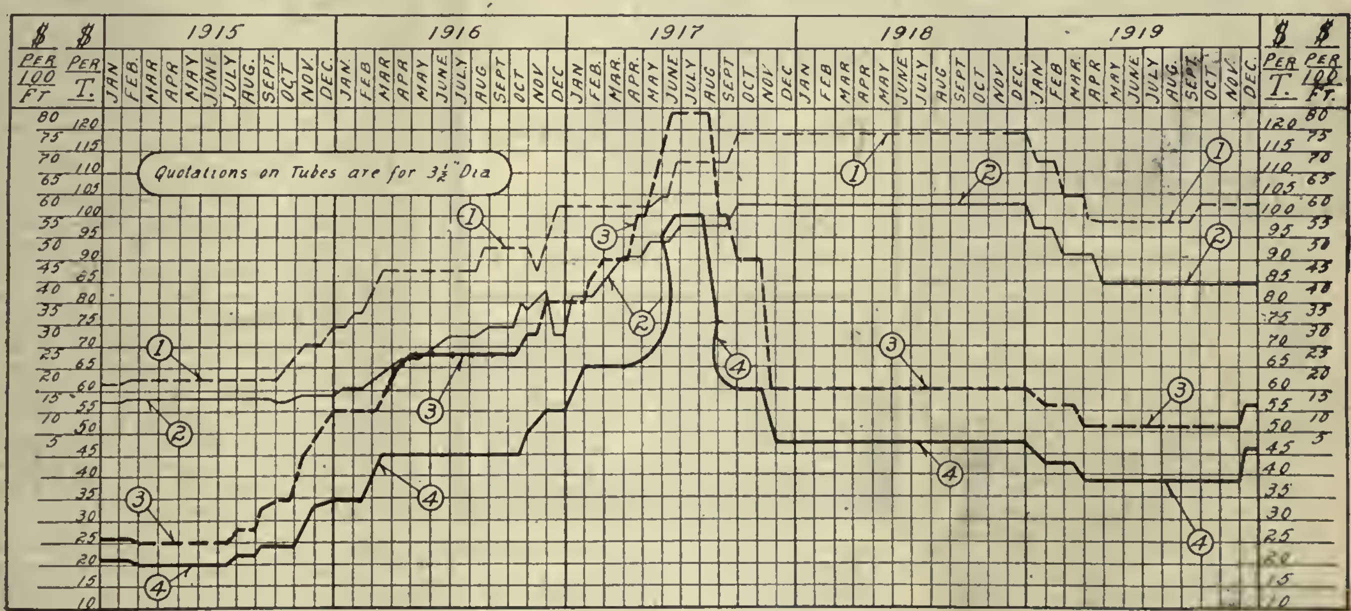
Shipments of Canadian products, approximating 30,000 tons a month, are going to Greece through the agency of the Hellenic States Trade Commission to Canada, with headquarters at the Drummond Bldg., Montreal. The bulk of this freight has been in grain, food and clothing as these are the present essential needs of that country. Stamos Zographakis, who is in charge of the Canadian office, stated that, so far, the trade developed by individual concerns was on a very small scale, and that personal representation would be necessary before increased business could be expected.

Everything possible is being done to reach the Canadian Government steamer "Canadian Spinner," which is drifting in the ice of the Lower St. Lawrence. The ice-breaker "Montcalm" is making every effort to reach the vessel and it is expected that this will be accomplished in a day or so. The "Canadian Spinner" has been fighting the ice for nearly two weeks, and unless the "Montcalm" succeeds in reaching her there is a grave danger of the vessel sharing the fate of the "Canadian Recruit," which is now stranded near the Saguenay River and will stay there until spring.

The Dominion Engineering and Machinery Co., a recently incorporated subsidiary of the Dominion Bridge Co., Montreal, has taken over the plant of the St. Lawrence Bridge Co. for the purpose of manufacturing pulp and paper mill machinery. Work of this character has been carried on by the Bridge Company for some time past at their own plant, but the increasing volume of business necessitated additional facilities for construction, so the shops of the St. Lawrence plant have been acquired and are being remodelled to carry on this new branch of the company's activities. A portion of the new plant is being fitted out as a modern foundry for supplying the necessary castings for the paper machinery and the line of turbine machinery which they have been making for the past year or more.

B. C. Coal for Industry.—The use of British Columbia coal for Canadian industries is a near possibility, according to Arthur V. White, consulting engineer to the Commission of Conservation. The large demand for United States coal and the high prices being paid for it, may make B.C. coal a commercial possibility in Ontario in spite of the long haul. The Canadian Manufacturer's Association is investigating the question.

Montreal Has Good Year.—The first year of peace was a great year for Montreal port. During the season of navigation 786 ships, 702 of which were Trans-Atlantic, visited the port. The total tonnage was 2,700,000, of which 1,646,532 were British. Inland transportation amounted to 7,499 vessels, of 4,357,734 tonnage. There were 84 vessels engaged in river and gulf traffic, as against 30 in the previous year. Navigation opened on April 14 and closed December 12. The first ocean vessel arrived April 22, and the last ocean departure was on December 10.



(Figures show cords, 000's omitted.)

	Seamless Tubes.	Tapweld Tubes.	Forging Billets	Bessemer Billets
Pre-war Price	$18.00	$14.00	$24.00	$20.00
Record High	77.00	60.00	125.00	100.00
Lowest, 1919	56.00	52.00	51.00	38.00

WHEN ANSWERING ADVERTISEMENTS KINDLY MENTION NAME OF THIS PAPER

Business Good Here.—The Mason Regulator & Engineering Co., Ltd., Montreal, have just completed and made the last shipment on a contract for the United States navy consisting of 2,000 Mason standard reducing valves, special navy type, flanged. All U. S. navy valves are tested to 450 lbs. hydraulic pressure. This was a stock order for the navy yards in different parts of the United States. It is interesting to note that this is the largest contract for reducing valves ever placed in Canada. This same firm have received an order from the National Shipbuilding Corporation, Three Rivers, for evaporator and feed-water heater equipment for five ships for the French Government. This company is also at the present time furnishing a considerable number of distillers for the drinking water to be used on Government ships.

Fire Did Not Stop Them.—The H. H. Robertson Co., Sarnia, manufacturers of asbestos-protected metals, had a slight setback through fire recently. However they will be in full operation again in a week or ten days, and there will be little, if any delay in orders. The company reports very encouraging bookings, not only for industrial buildings but also for storage and transportation structures.

DOMINION STEEL CORPORATION

(Continued from page 76)

space occupied is 37 x 34 feet. The floor space occupied is 37 x 34 feet. The total weight of motor and flywheel is 659,000 pounds. The asembling of this machine, after its arrival on the ground, requires three months' work.

The Power House

A large power station is being built to furnish the power required for operation. The power house will be equipped with steam-driven generators, the steam boilers being fired with gas from the blast furnaces. The steam from the boilers will drive steam turbines direct connected to alternating current generators. There will be a unit of 5,000 k.w. and one 1,000 k.w., a smaller one of 500 k.w. being also fitted. Besides driving the plate mill, the 28 in. rail mill will be also connected to this powerhouse. The power-house is of brick concrete and stel construction, and will be equipped with a travelling crane of fifty tons for handling the heavy machinery. The dimensions are 80 feet by 100 feet, and provision has been made for further extensions. The company will gradually substitute electric drive through all their buildings to replace the individual steam engines.

Every effort is being made to have the mill in operation early in the year. All material is traced from the manufacturer to the mill, and no cars are allowed to be side-tracked on their journey. It will be a big thing for Sydney and for the Dominion generally when this mill rolls its first plate.

Have Reorganized.—The Ingersoll Machine Co., Ingersoll, after a thorough reorganization following their activity in war work, now have their plant thoroughly equipped for the production of high quality gear and milling cutters, thread millers, reamers, three-lip drills, etc. This concern proved an important addition to the group of Ingersoll's industries engaged in the manufacture of high standard tools.

America Gets Ship Contracts.—Although the price per ton is much higher than that of British yards, several contracts have gone to American builders recently through inability of British firms to take any more work just now. The Pusey & Jones yard on the Delaware have taken an order for 12,000 ton deadweight tank steamers, and the Bethlehem Shipbuilding Corporation have received orders for four 10,000 ton vessels of the same type. The price is said to be in the neighborhood of $205 per ton. While British prices are considerably below this, they cannot compete on a delivery basis.

C.P.R. to Make Improvements.—Half a million dollars will be spent on improving the lines of the C.P.R. in the London Division next summer, according to an announcement by Mr. Williams, superintendent of the division. One of the largest amounts will go towards installing an automatic block system on the main line.

British Columbia's Ship Output.—During the year of 1919 the shipbuilders of the Pacific Coast built 170,500 tons. This included ten steel and forty-six wooden vessels. The French Government took forty wooden vessels, the Imperial Munition Board took four steel steamers, and six have been built for the Canadian Merchant Marine.

Company Loses Action.—The Russell Motor Car Company lost the decision in an action brought by them against various railway companies for loss of 3,838 castings, which had disappeared in transit. The action was dismissed on the grounds that the company did not count the contents of the freight car on the morning that they broke the seals.

Insure the Employees.—The Taylor-Forbes Company, Ltd., of Guelph, Ont., is putting into immediate effect a profit-sharing plan by insurance for its employees. A notice to the employees states that the Taylor-Forbes Company has insured the lives of all its employees according to the length of service with the company, beginning after the first three months with $500, and ending with $3,000. Medical examinations are not required. Any employees who were in the army will be allowed full time for such service as part of their working years. Every year of continual service with the company will add to the insurance policy value up to $3,000. It will not in any way interfere with any advance in wages or earning capacity.

Vancouver.—The Coughlan Shipbuilding Company successfully launched the steamer "Canadian Exporter," 8,100 tons deadweight, for the Canadian Government Merchant Marine recently

CLASSIFIED ADVERTISING SECTION

Rates (payable in advance): Two cents per word first insertion; one cent per word subsequent insertions. Count five words when box number is required. Each figure counts as one word. Minimum order $1.00. Display rates on application.

HELP WANTED

AGENTS WANTED THROUGHOUT DOMINion for Cowan Transveyors. Address R. B. Smiley, 120 Glenholme Ave., Toronto, Ont.

FIRST-CLASS MACHINIST WANTED

EXCEPTIONAL OPPORTUNITY FOR MAN OF ability and education to become demonstrating rate setter. Requirements are thorough knowledge of machine tools and skill in their operation, initiative, perseverance and tact. In reply, please state age, experience, salary expected and when available. Box 646, Canadian Machinery. (c4m)

POSITIONS WANTED

MECHANICAL SUPERINTENDENT OR GENeral foreman seeks position. Extensive experience in layout work, designing, developing, manufacturing and maintenance work in light, medium and heavy work. First class executive with initiative ability. Apply Box 647, Canadian Machinery. (c3m)

AGENCIES WANTED

CANADIAN AGENT WANTED TO HANDLE line of Black Diamonds, Diamond Tools, etc. Address Box 643, Canadian Machinery. (ctfm)

MACHINERY WANTED

USED, IN GOOD CONDITION, PUNCH AND Shear to punch 1" hole through 1" plate, depth of throat not important. One 36" Gap Lathe; also several Engine Lathes from 13 to 18" Swing. Apply Box 644, Canadian Machinery. (c28m)

WANTED—SECOND-HAND METALLURGICAL microscope. State make and price and if fitted with camera to take photo micrographs. Box 648, Canadian Machinery. (c3m)

IMMEDIATELY — ONE PHOTO-STAT MACHine. Must be in perfect working order. Send photo and full description of make and prices. T. McAvity & Sons, Ltd., Box 700, St. John, N.B. (c2m)

WANTED.—Jones & Lamson Turret Lathes, 2 x 24 and 3 x 36. Either friction or gear feed. State full particulars and lowest price. Box 645, Canadian Machinery. (ctfm)

FOR SALE

NEW MITRE BOX PATENT

IF YOU ARE INTERESTED IN BUYING A patent for the latest labor-saving device in mitre boxes, address Box 636, Canadian Machinery.

FOR SALE—BRAND NEW INGERSOLL-RAND After-cooler, never used, for compressor up to 14 x 14". London Mfg. & Machine Co., Ltd., London, Ont. (ctfm)

FOR SALE — WATSON-STILLMAN HYDRAUlic Press, complete with four-plunger automatic variable belt pump. A. G. Crawford, 14 Mall Bldg., Toronto, Ont.

FOR SALE — AT REASONABLE PRICES. Genuine Swedish iron bars. Full assortment of sizes. Apply Dillon Crucible Alloys, Welland. (c7m)

PATTERNS

TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (cfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

MACHINE WORK WANTED

MACHINE WORK WANTED FOR LATHES, shapers, milling machine and planer, etc. Hourly or contract basis. Prompt delivery. W. H. Sumbling Machinery Co., Toronto. (ctfm)

NOW!

You've been going to send in that ad for weeks, so why not mail it now for next week's issue.

Canadian Machinery
143-153 University Ave., Toronto

THE "WANT" AD.

The "want ad." has grown from a little used force in business life into one of the great necessities of the present day.

Business men nowadays turn to the "want ad." as a matter of course for a hundred small services.

The "want ad." gets work for workers and workers for work.

It gets clerks for employers and finds employers for clerks. It brings together buyer and seller, and enables them to do business though they may be thousands of miles apart.

The "want ad." is the great force in the small affairs and incidents of daily life.

Manufacturers desirous of selling in Great Britain are asked to give particulars to

Furniss Clarke & Co.
Room 63
364 University St., Montreal

WANTED.—Second-hand crude oil stationary engine, about 50 H.P., or two engines that will give that power.
The Miramichi Quarry Co., Ltd.
Quarryville, N.B.

Full line of
Honestly Rebuilt Machine Tools at bargain prices.
Special price on 20 inch x 8 ft. C.M.C. Lathe.
STANDARD EQUIPMENT & TOOL WORKS
179 St. James St. - MONTREAL

SAY YOU SAW IT IN CANADIAN MACHINERY

WANTED

FOUNDRY

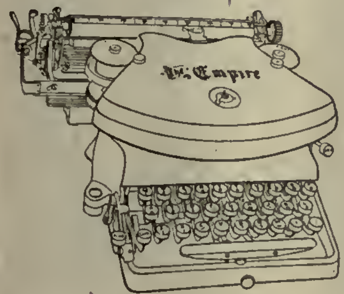
to make

high-grade Gas Engine Cylinder Castings. Submit full particulars as to experience, capacity, and references to present connections.

Box 649, Canadian Machinery

CANADIAN MACHINERY AND MANUFACTURING NEWS

Volume XXIII. No. 3. January 15, 1920



Making the Empire Typewriter

Some of the Important Features of Construction are Discussed and Interesting Operations Shown

By J. H. RODGERS

IN the year 1844, C. W. and John Williams Commenced building sewing machines in Montreal. They occupied a small shop on Dowd Street, and from this humble beginning has grown the present organization of The Williams Manufacturing Co., Limited, with modern factories at Montreal and Plattsburgh, N.Y., and sales offices in Montreal, Toronto, Hamilton, St. John in Canada, and in New York and Washington in the United States.

In 1895, manufacture of typewriters was commenced in Montreal, and in 1897 this line was also added to the activities at Plattsburgh.

The Company grew rapidly in both quantity and quality of output, and in 1916 devoted almost its entire plant to the manufacture of time fuses for the British Government, making over 1,000,009 of these intricate devices. During the war, the Plattsburgh plant was also busy on munitions, and made many millions of time fuse needles.

Since the war, the company has developed new lines of manufacture, and is now making the Wedgerite Piston Rings in both plants, as well as gramophone woodwork and parts at Montreal.

Because of the exceptional character of the modern machine tool equipment purchased for war work, and having a splendid new five-storey building with 50,000 square feet of available floor space, this company is fully justified in looking forward to a bright future, and it is now considering several promising new lines of manufacturing development.

The company began the manufacture of the "Empire" typewriter in the year 1895. It is not the purpose of this article to go into the manufacture of typewriters in detail, but rather to dwell on some of the more important features of construction that makes the "Empire" equal in efficiency to others of more complicated construction.

The frames for the different machines are made on moulding machines, and the castings are all annealed before being machined. A special Pratt and Whitney profiling machine is used for milling off the various hubs and bosses. This machine is fitted with a long, small drum at the rear that serves as a driving pulley for the two vertical spindles, which are connected to the driving pulley by means of the mule drive. The different operating positions for the cutters are regulated by adjusting stops, located on the side of the frame, for controlling the vertical travel of the cutter.

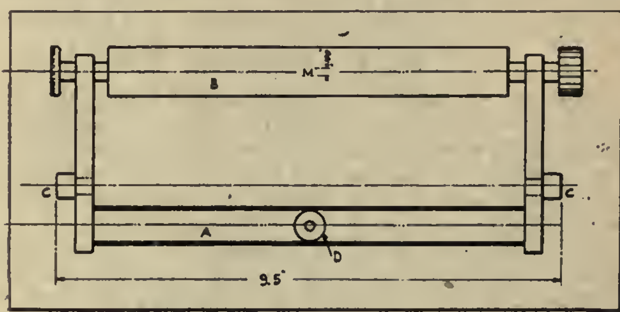
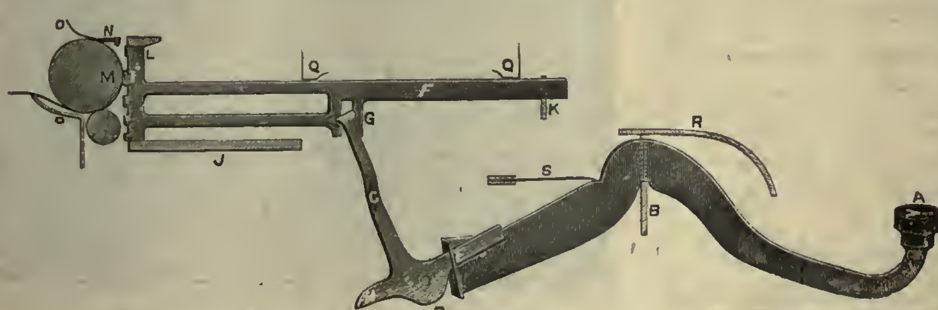


FIG. 1—ARRANGEMENT OF PLATEN AND STEEL GUIDES.

The spindle head is operated laterally on the cross rail by means of a rack and gears operated by the handle at the front of the machine. The side movement is controlled by stops on either side of the cross rail.

The drilling of the frames is accomplished in several four-spindle machines, and the jig used is designed for drilling from all six sides—a total of 56 holes are drilled before the frames are removed from the jig. Drilling takes place after the frames have been japanned and baked.



DETAILED DIAGRAM—SHOWING ACTION OF KEY.

FIG. 3—TYPE ROLLING MACHINE.

All the small screw parts are made in the plant, and a number of Brown and Sharpe and Davenport automatics are installed for this purpose. All small screws and working parts on the machines are hardened, after which the screw heads are polished and blued by immersion in hot sand.

The type bars and key levers are given a special heat treatment, by immersion in a red-hot solution that leaves the parts with a clear, black, pleasing appearance, and free from any signs of warping, even though the parts are long and slender.

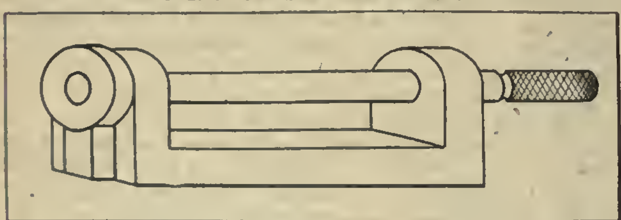
The assembly is done in stages, the machines passing from one operator to the other, each operator having a certain duty to perform in the assembly of the machine.

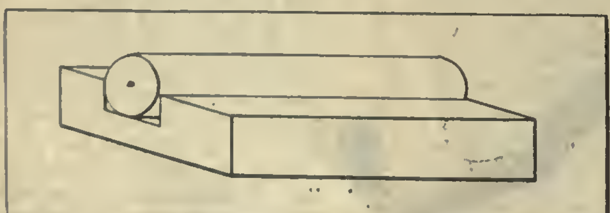
Type Alignment

The principal merits of the "Empire" design are simplicity, directness and durability. In the type action, which is the heart of a writing machine, there is only one intermediate between the key lever and the straight thrusting type-bar. This feature insures a powerful and accurate type impression and clear manifolding.

The type are held in alignment at the printing point by hardened steel guides, which maintain the type impression, both vertically and horizontally, and to determine the continued straightness of the printed line, the Platen "B," Fig. 1, which receives the type impression, is aligned by being guided by a fixed roll D positioned directly under the centre of the printing point. This novel arrangement prevents the possibility of any in-

FIG. 6—OIL STONING DEVICE.





FG. 7—FIXTURE FOR TESTING MASTER TYPE.

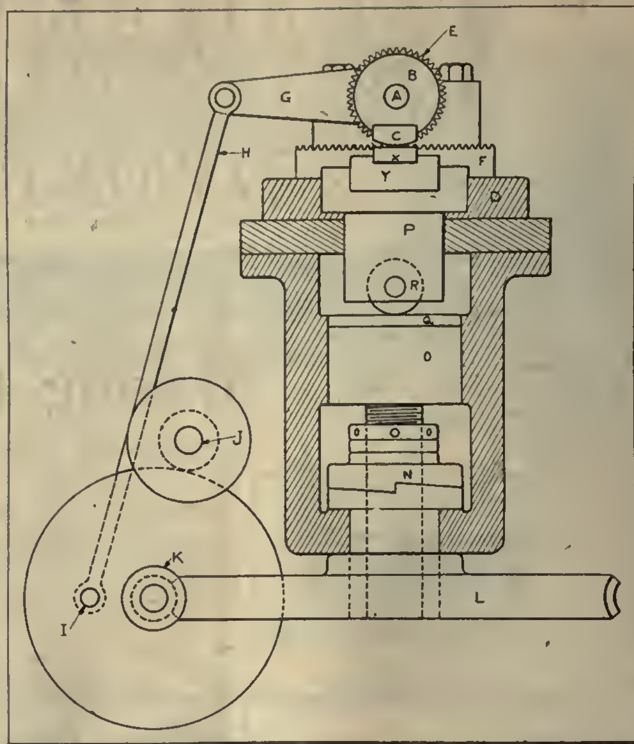


FIG. 4—KNEADING MACHINE FOR MAKING TYPE.

FIG. 5.

FIG. 8—TYPEWRITER MAIN FRAMES DRILLING JIG. 56 HOLES ARE DRILLED IN THIS FRAME.

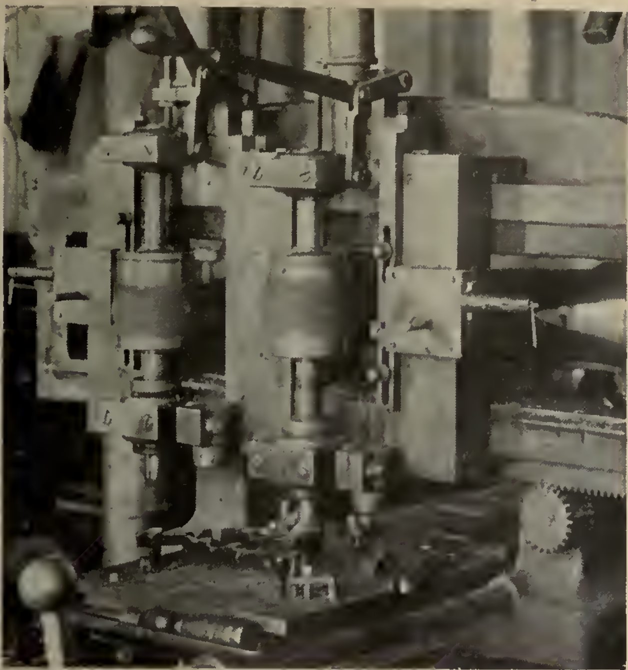


FIG. 9—PROFILING MACHINE MILLING TYPEWRITER FRAMES

accuracy being caused by wear of the carriage raceway or balancing mechanism.

The only requirement of manufacture to assure a constant printing line along the face of the platen is that the groove A, which positions the carriage for capitals or figures, be maintained parallel with the centre line of the roll or platen. This guide groove, not being subject to wear, determines the printing point correctly. Even should some wear occur in the balancing arm joints C, it would only cause a tilting of the letters in relation to the printed line, and this actual tilt would be reduced in the proportion of at least 85 to 1, as the length of the line between pivots is never less than 9½ inches, while the height of the letters is seldom more than .100 inches. It is, therefore, apparent that wear in the carriage will not affect the vertical alignment of the printing point.

The result is very different in the usual type of carriage paralleling device, in which the guide roll is fixed to and travels with the carriage, for any wear in the joints results in an increased inaccuracy of the position of the printing point as the carriage travels to either the right or left end of the raceway.

FIG. 10—SPECIAL GORTON ENGRAVING MACHINE ADAPTED TO MILLING TYPE MATRICES.

Rolling the Type Faces

In considering the manufacture of the type in the early days of the "Empire," it was found that the forming of the letters or characters was practically a secret process very carefully guarded. So it was necessary to design a machine for rolling or kneading the type faces. These type are made of a special soft grade of steel, which is case-hardened after machining. The blanks are punched out to approximate size, allowing sufficient material to force into the matrix of the kneading machine and produce the desired type. The face of these blanks is then polished to prepare the surface for forcing into the matrix or master die.

By referring to Fig. 4, it will be seen how simple the kneading machine is. Mounted on the rocker-shaft A is the matrix holder B, in which the matrix C is secured. This rocker-shaft is geared directly to the reciprocating table through the pinion E and rack F, both of which are of steel, heat treated. The pitch line of the pinion E is maintained constant with the pitch line of the matrix C at the bottom of the impressions or type faces, which insures that the travel of the matrix at this diameter is identical with the movement of the reciprocating table.

This table D carries the type X clamped in the type holder Y. The shaft A is oscillated through the rocker arm G connecting rod, crank pin I and drive shaft J, and this oscillation provides a true rolling motion between the matrix C and type face.

In order to force the type blank into the impression in the matrix, the driving shaft K carries the worm K, which engages worm-wheel L mounted on vertical shaft

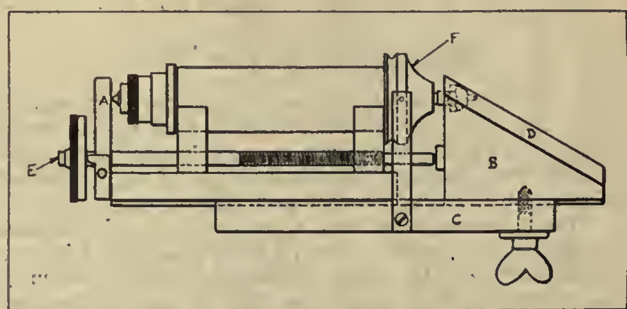


FIG. 11—FIXTURE FOR STONING CUTTERS.

M. This vertical shaft carries a double-face cam N, which lifts the slide O twice each revolution. This upward lift is communicated to the ram P through the hardened steel thrust plate Q and roll R. The type-holder being mounted directly on the ram, rises about .001 inch for each oscillation of the matrix shaft, and completes a type in thirty oscillations, the idle time for loading and unloading the type being about 15 or 1-3rd oscillations of the total time.

This machine takes the thrust of the rolling directly through the heavy bearings of the shaft and the yoke frame carrying the double-face cam, and an idea of the utility may be formed by the fact that it was found unnecessary to make any changes in the design, other than to increase the calculated speed of the drive shaft about 50 per cent., and one of these machines was used steadily for ten years without any repairs being necessary to the face cams or worm.

The making of the matrices for the type was an interesting problem, and at first master type were used, the blanks for these being made up of tool steel, as shown in Fig. 5, the radius N being slightly larger than the radius of the platen, and the depth of the master V being exactly equal to the distance between the capital and small letter on the type. The radius N was first milled, then ground true, and coated with copper. The

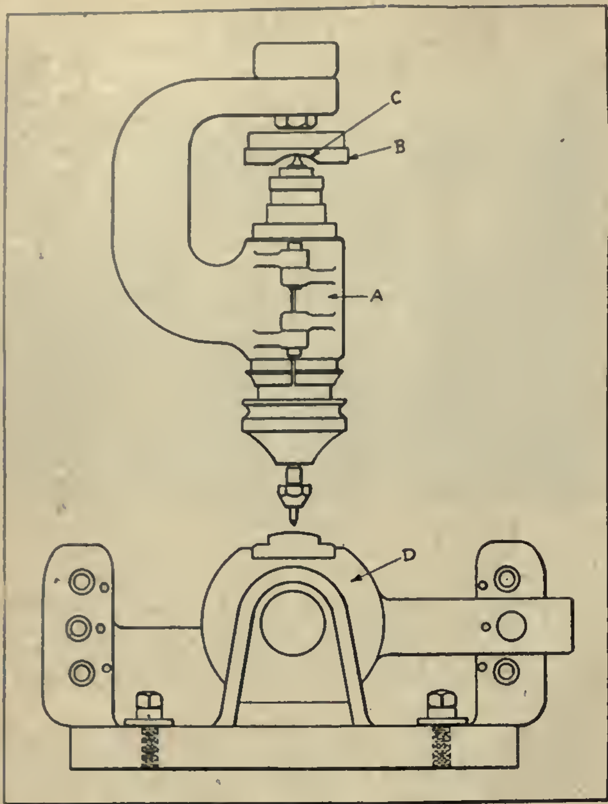


FIG. 12—ENGRAVING MACHINE SPINDLE.

Making the Master Type

lines to determine the outline of the character required were next laid out on the coppered face of the radius, using a micrometer height gauge, and an expert steel engraver cut the type to the lines, using the microscope as a check for height, width and alignment.

The masters were then carefully hardened, the faces of the type finished in the oil-stoning device, Fig. 6, to proper radius, and after examination under the microscope and passing a printing test in the fixture shown in Fig. 7, they were grouped together and forced into a blank matrix in the type-rolling machine previously described. This blank matrix was next dressed down to proper radius on the outside diameter, then hardened and used in the type rolling machine to produce the type.

Making the Matrices

While this process gave good results, it became apparent that the engraving of the master type required such precision and care, that even the most skillful workman could not remain continually on this class of engraving without undue strain to the eyes and nervous system. The method finally evolved was developed by adapting a Gorton engraving machine to the work. To provide for a roughing and finishing cut in engraving the matrix, two ball bearing grinding spindles were mounted in cylindrical quills, as shown in Figs. 10, 11, 12, these quills, being exactly concentric with the grinding spindles, interchange accurately in the hinged spindle carrier A of the engraving machine, the finishing cutter following the path of the roughing cut very evenly, and finishing the type faces to a smooth and accurate surface. The spindle quills were provided with a limited vertical motion, the spindle bearing sleeve being pressed upwards by a spring against the form plate B, bringing the ball point into contact with the curved surface C, which determines the radius of the type faces in the matrix. This curve C is not identical with the type face, but is a resultant curve, calculated to generate the proper curve, when used in the type rolling machine. The roughing and finishing cutters must run true, be exact as to angle of cut, width of point, and an exact even length from the top of ball point to point or face of cutter.

Grinding the Cutters

To fulfil these requirements, the cutters are sharpened by being mounted in the fixture, Fig. 11, which receives the spindle quill in the half bearings shown—the ball point being forced by the spring against the fixed stop A.

The stoning block B carried on slide C has the hardened bevel plate D, which determines the angular length of one face of the cutter. To feed the stone to the cut, a micrometer screw E, with dial graduated to .0005 of an inch positions the stoning block B in relation to the cutter. The four faces of the cutter are brought successively into parallel with the bevel plate D by a four position dial on the spindle drive sleeve F, controlled by the index lever.

In stoning the cutters, each of the four faces of one cutter is stoned to alignment with the bevel plate D, the other cutter quill is then substituted and cutter stoned without disturbing the setting of the micrometer screw. This operation leaves the cutting faces pyramidal and the points sharp. In order to form a cutting edge of a definite width, the bevel stoning block is advanced .0035 in. by micrometer screw E and two opposite faces are stoned down to the plate. This is repeated on the other cutter, and assures that the cutting points shall be true and even in width, angle and length. The type face is approximately .003 in. wide. The cutters being ready, a matrix is mounted in the holder D, shown in Fig. 11, and the depth of cut determined by the vertical feed dial and index.

Laying Out New Type

In originating, or laying out a new type or character, the following process is adopted:—

FIG. 13—REFERENCE GAUGE FOR TYPEWRITER CARRIAGE ENDS.

Section line paper charts are made, with fine lines spaced at .002 inch intervals. The letters are now laid out fifty times larger than required.

By using so great a reduction, it becomes easy to reproduce any required character, and many peculiarities of vision are discovered and easily corrected. For instance, a capital L must be made thus, L, in order to look plumb in the finished print; a small t must be inclined to the right, a small d very slightly to the left, a round letter must be slightly larger than one having square top and bottom, as o or e must be a little taller than n or m.

When a request comes in to make a type to match sample, it is enlarged directly by using the microscope fitted with Camera Lucida, tracing a rough outline on the chart and then correcting it to match the limit lines of the chart. These paper charts are next mounted on

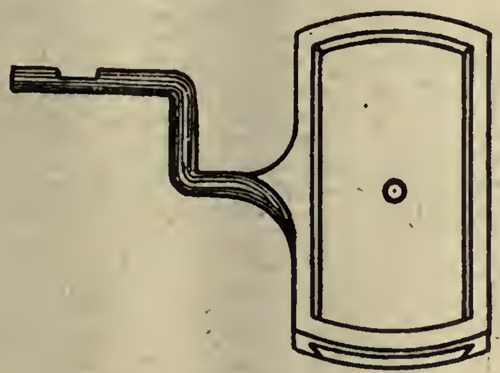


FIG. 15.

the copy table of the engraving machine and reduced three times to form the brass copy plates.

Anyone who has tried to follow a fine line with a vertical pointer knows how difficult a job it is. To make this operation more easy, the vertical pointer was replaced by a light steel frame, Fig. 15, carrying a thin glass slip which is marked on the under side with a small circle, the inner diameter of which is but slightly larger than the width of the lines on the chart. With this device it becomes an easy matter to follow any straight or curved line, as there is no pointer-shadow and the operator looks directly at the chart through the glass, instead of having to try and see two sides of the pointer at once, as when turning a sharp corner or angle. Having the master copy, as required, it is very easy to make duplicate type at any time without any special manual skill.

In the making of the Empire typewriter, attention is given to the world-wide distribution of the machine, and characters for many languages are continually required in typewriters going to foreign lands.

In repairing a drawbridge across the Passaic River, at Newark, N.J., it became necessary to remove a casting and pin from a granite pier. After several unsuccessful attempts to draw the pin, as narrated in Stone, the pin projecting down 3 inches into the masonry, it was found necessary to cut a trench in the hard granite so that the casting might be shifted laterally to one side for removal and replacement by a new and larger centre casting. This trench was 4 ft. long, 9 in. wide and 3 in. deep, extending under the old casting. The cutting of the trench would have been an endless task had it not been discovered that an oxy-acetylene flame chipped the granite quite readily and could be used under the old casting without damaging the balance of the masonry. The desired channel was thus quickly obtained. The flame was also used for cutting away the abutment back of the fixed span bottom chord to provide expansion clearance.

The manufacturer of a new chain is reported to have found a way to make chains that will not buckle. The flattened wire is put through a machine that loops it, forming links by bending it back and lapping it over in such a way that the links in the series cannot drop back and wedge, as sometimes happens in flat chains.

A master mechanic of the electric railway at Schenectady has invented a device that can be attached to any snow plow. A cutter spindle of wooden drums is mounted on one end of a regular snow plow. On the drum surface are numerous cutters or ice teeth of steel, seventy-two in all. As the drum is revolved, the ice melts away in its path. A motor on the floor of the snow plow cab drives the cutting device.

In sinking a mine shaft at Kendall, Montana, through old heavy timbering the wood was cut very handily by using a wood chisel with a cutting edge 2 in. wide and operated by a Jack-hammer drill arranged to work without rotation. This was used for cutting off logging, planks and ends of timber, which was accomplished rapidly and easily.

A gypsum process of dry scouring wool is said to have been discovered in boys' play; that while the developer's sons were playing on the sands of the Almagorda Desert, their greasy clothes were cleaned as if by magic. On investigation and experiment it was developed that gypsum of a high degree of dehydration absorbs the moisture present in wool, chemically breaks down the fatty and heavier materials adhering to the fibres and removes them along with the moisture.

What is believed to be a world's record for gliding with a dead motor was accomplished at Ithaca, N.Y., in a Thomas-Morse two-seater biplane. This machine flew to the head of Cayuga Lake, a distance of 35 miles, and having attained a height of 17,500 feet, the pilot switched off his motor and glided to Ithaca, at which point he still had 5,000 feet altitude. If his glide had been continued it is estimated that an additional 15 miles could have been covered, making a total of 50 miles without the use of his motor. The longest glide previously recorded was that of Capt. Raynham, according to "Aeronautics," when he glided from Brooklands to Hendon, in England, a distance of 22 miles.

Hanny in St. Joseph News Press

"HOW AM I GOING TO SHOOT THE ONE WITHOUT HURTING THE OTHER!"

Canadian Machinery Drafting Course--Part XI

This Section Will Be Divided Into Two Parts, the First Being Devoted to the Discussion of "What is a Working Drawing" and Other Fundamental Principles Involved

By J. H. MOORE, Associate Editor Canadian Machinery

FOR the benefit of those readers who perhaps did not care to follow up the preceding and elementary plates connected with this course, we believe that a short explanation of what is meant by mechanical drawing would not be amiss.

The need of some means of illustrating to workmen the operations they are to perform is so self-apparent that it is not necessary to dwell on this point. The method employed, however, differs in some cases. A rough sketch is sometimes all that a workman has to go by, and even the sketch is not always available, in which case verbal instructions are merely given. This poor practice we are glad to say is dying out, for results have proved that verbal instructions may be all right in their place, but that their place is not where the making of some detailed piece of machine work is concerned.

In the up-to-date shop of to-day we are sure to find a drafting room where mechanical drawings of all kinds are prepared for use throughout the plant. What is this art of mechanical drawing? There are various ways of explaining the meaning of the term, but perhaps the two given below are as good as any.

Mechanical drawing is the art of exact representation by means of drawing instruments of precision. It differs from freehand drawing because it uses instruments, and, in general, aims to reproduce the object, not as it appears to the eye in perspective but in its actual relations to the space it occupies.

To put it in a different form, we might say that mechanical drawing is a term usually restricted to drawings representing machines, machine parts, and other objects used in the mechanical arts. In other words, a mechanical drawing is the language employed by the designer of machinery to convey his idea to others, who will be engaged on the building up of the idea.

So far in this course we have not touched upon the actual art of mechanical drawing, but have been simply leading up to it through the elementary plates which described the fundamental principles involved.

What is a Working Drawing?

Any workman who constructs a machine or makes machine parts from a drawing is said to work to drawings. On this drawing must be all necessary dimensions to allow its completion, which of course gives it its well-known term of a working drawing. The only difference between a working drawing and an assembly view of a machine for instance, is that while all dimensions are given on the former, the latter is merely an assembly to illustrate how the complete machine goes together, therefore requiring no dimensions. Of course, in some cases it is advisable to place dimensions on an assembly drawing, but immediately the first dimension goes on a sheet of this nature it becomes at once a working drawing.

We can now safely state that there are two classes of working drawings, viz.: assembly (or general drawings as they are sometimes called), also detail drawings.

As before stated, the assembly drawing illustrates to the workman the relation between and the positions occupied by the component parts of the structure no matter what it may be. Dimensions given on such drawings are usually only the leading ones, such as length over all, distance between important points, and so on.

Detail drawings, on the other hand, show the exact shape and size of every integral part. For this reason they are supplied with every dimension required by the workman, together with any additional notes that the designer or draftsman may consider necessary.

Detail drawings may be made so complete that they will be equally useful to the patternmaker, machinist, or even blacksmith. This policy is usually carried out in the smaller shops where expense is a big item, but in the larger shops the better policy of separate drawings for each trade is adopted. Only such dimensions are placed on the patternmaker's drawings that interest him, and so on. This latter policy pays in the long run, as fewer mistakes and speedier work is obtained.

Standard Drawing Practice

To give readers a standard drawing practice is impossible Were we to quote one drawing office method and suggest working to that we should only hopelessly muddle the student, so for the purpose of the course we can only suggest that you work to the style shown on each plate, acquainting yourself in the meantime with the different styles of drawings which may happen to pass through your hands.

It is often impracticable to make a drawing of a certain part full, or life-size. This is especially true when dealing with large machinery.

Scale drawings are then used, the object being drawn to some reduced scale. For example, suppose some object is 4 ft. long and it is desired to reduce it to 12 in. in length. This represents a reduction of ¼ or an equivalent of 3 in. to 1 foot. This scale would therefore be termed as 3 in. = 1 foot.

The triangular type of scale which we illustrated in an earlier portion of the course is much used in drafting practice. No doubt our students are supplied with a scale of this nature, and by this time have studied and mastered the various scales represented on it. If they have not done so they should at their first opportunity, for a good working knowledge of these scales is essential to accurate and quick work in laying out objects to reduced size.

In some cases when the size of his drawing is limited and the scale of reduction must not be too great, the draftsman has to resort to the use of a special scale not found on the triangular type. When this happens he can adopt two methods: First, he can purchase some other rules having a greater range of scales marked on them, or second, he can make a scale for himself on good stiff drawing paper or on thin Bristol board. Usually a draftsman engaged at the profession has, as a part of his kit, various rules on which are all the scales he will ever require, but again there are others who would rather make their own. Should students attempt to make a scale for practice, remember that the distances must not be marked according to the eye but by the geometrical method.

What is a Draftsman?

As a rule there are three classes, who take on the following rank: First comes the designer. He, as the name indicates, designs the structure or apparatus whatever it may be. Next in order comes the chief draftsman, who takes charge of such work as turned out by the designer and sees that it goes through the various steps to a successful completion. In many cases the chief draftsman and designer are rolled into one position, the same chap occupying both positions, while in other cases the chief draftsman is the high and mighty one, with the designer next in prominence.

Then comes the detailer, who takes the assembly drawings and makes up the details from them, calling for the proper material, parts, etc. As time goes on a good detailer can achieve the position of designer without any trouble.

Last comes the tracer, who takes the pencil drawings and makes tracings for reproduction purposes. His work in turn can be used to good advantage in preparing himself for detailer. It is more than probable that many of our readers are already acquainted with this routine, but it is for the benefit of others not so conversant with drafting room practice that we state these details.

As a general rule the apprentice starts by taking care of the filing system in the drawing office. From there he steps to the task of blueprinting, then to tracing. Detailing comes next, after which comes the actual designing. The writer personally passed through the lot, and before reaching the coveted position of chief, used to think he was too blamed long on the other side lines, as he termed them. This personal note is placed in this article with a purpose, namely, to warn those who are almost too enthusiastic as to their own particular ability.

Looking back on the incidents at this late date, the writer can readily see why he was kept so long at each particular portion of the business. As the Chinaman said, "It allee comes out in the washee," so never be discouraged but keep on plugging.

Things to Watch

We will supose we have passed the duties of filing and blueprint making, and reached the stool at the tracer's table.

The necessity of carefully following out all instructions in making tracings cannot be too forcibly presented. Careless, slovenly work will at once create a bad impression, while careful, painstaking work will immediately place the tracer in favorable standing with his employers. Work slowly at the start until each subject is well in hand and thoroughly understood. True, speed is important, and will come later, but accuracy must come first.

From the commencement the student should remember that neat and accurate work is essential, that all lines, figures, and even the title must be clear and distinct.

There must be no doubt as to the meaning of the dimensions, or limits, if any are shown on the drawings.

Mistakes made on the drawing are easily rectified if caught before leaving the office, but it is a different proposition if they once reach the shop. Not only does the piece on which the mistake has been made become scrap, but the error may not be noticed until an attempt at final assembly is made. This not only necessitates a new piece being machined, but holds up production, thereby causing considerable dissatisfaction throughout the plant.

Another point to be guarded against is needless complication of a drawing. By that we mean that the student must not get into the habit of duplicating his dimensions on all views. Only place dimensions where absolutely necessary. This does not mean to be so stingy with your dimensions that you leave out various detailed dimensions which mean so much. When a drawing leaves the draftsman's hand marked complete, it should not be necessary to refer to him for further particulars.

Be Careful of These Points

Never write a fraction like this, 5/16. Always make the dividing line horizontal. For example: $\frac{5}{16}$ in. looks much better than 5/16 in. Watch this point for it has caused many an error. Suppose we had a dimension $1\frac{1}{16}$ in. Through carelessness we mark it 11/16. Which is it, $1\frac{1}{16}$ in. or $\frac{11}{16}$ in.? Catch the point?

Abbreviations are only used where lack of space prevents the complete word being printed. There are a few used at all times, such as diam. for diameter, rad. for radius, thd's for threads, and f for finish. These points will be taken up at a later date, however.

When the word drill is used it is taken to mean that the hole is put through the piece by drilling. Ream on the other hand means that the hole is finally finished by reaming. The word tap is well understood. For instance, a hole is marked 1 in. 8 tap. This would infer that a 1 in. 8 threads to the inch tap was to be used.

The word cored implies that finish is unnecessary, the hole being produced by a core in the mould. All cores are of course arranged for by the patternmaker. The terms: shrinking fit, forced fit, driving fit, turning fit, and so on, always imply that the workman is to make allowance for the style of fit called for. These fits are a question of discussion as one plant may make different allowances from others.

f. all over, infers that the piece so marked has to be machined, or in other words, finished all over.

Should you desire to convey special information on your drawing, do not depend on abbreviations but write out your instructions in good plain English so that it cannot be misunderstood.

(To be continued)

SOME MORE PRIZE WINNERS

READERS interested in our drawing course are not sending in their work as promptly as we would like. To those reading this notice we request their co-operation.

Now that we have started on Mechanical Drawing, new students should be added to our list, for many have no doubt held back until the straight mechanical details were started.

The class of work coming in, while up to fair standard, does not deserve three prizes on each plate, so that we are only awarding such prizes as we think advisable.

Again we emphasize the necessity of letting us see your work. Winter is here and the long evenings at home are just what you need in preparing the various plates, so go to it, allowing us to see the result.

Following are the winners on plates Nos. 4, 5 and 6:

Plate No. 4—A. M. Richmond, 1120 16th Ave. West, Vancouver, B.C., Canada.

Plate No. 5—D. Rathwell, 12 11th Ave., Lachine, Que., Canada.
Wilfred Wandle, 89 Gowan St., Allandale, Ont., Canada.

Plate No. 6—Leonard Snary, 170 E. Superior St., Chicago, Ill., U.S.A.
Carl Rowson, Box 632, Port Hope, Ont.

Experiments to test the effect on the eye of different illuminants are described in the "Transactions" of the American Illuminating Engineering Society by Messrs. C. E. Ferree and G. Rand. They included various electric incandescent lamps—carbon, tungsten, tungsten with blue bulb—and a kerosene lamp. Results are plotted in terms of "time clear to time blurred" to indicate the degree of fatigue as in previous work. The results suggest that the color is an element of some consequence. The loss of efficiency of the eye, on the above criterion, was least with a tungsten lamp giving a "white" light, greater with a carbon lamp and a kerosene lamp, and highest with the lamp with a blue bulb. It thus appears that the least fatigue was sustained with the light approaching nearest to white.

Four Automobile Production Milling Fixtures

The Automobile Producing Field Demands Maximum Production in All Branches of the Business. Herein Are Four Examples of Fixtures Arranged for Use on Various Types of Millers

By J. H. MOORE

THE use of the milling machine as a rapid remover of metal is already too well known to need comment. The finest miller in the land, however, will not accomplish its intended purpose, if not properly equipped, both as to cutters and proper fixtures.

It's the same old story over again where a manufacturer purchases a machine with no actual conception of its possibilities. The writer, in passing through many a plant, has noticed some huge all-geared, motor-driven miller, with a miserable 3½ inch or 4 inch x ⅝ inch milling cutter, chopping away at a job that really belonged on a much smaller type of machine.

If readers doubt this statement, let them look around, when they will be surprised to find that, unfortunately, there is a great deal of truth in the remark. Of course, the writer speaks of the average machine shop and not the type of automobile manufacturing concern of the present day.

In a plant, such as the Willys-Overland Co., of West Toronto, it is absolutely essential that production reaches the maximum point. This means that every conceivable fixture that can be devised to facilitate the product is brought into use. In this respect, the milling machine is not forgotten.

The millers are so arranged to receive certain operations, each operation being right up to the capacity of the machine. No small work is placed on a large-sized miller, for that would show lack of judgment on the part of the production engineer.

Every fixture is designed to handle the product just as speedily as the machine will turn it out. To illustrate what we mean by efficient fixtures, we show four different views of milling fixtures used on work for the Overland Four car.

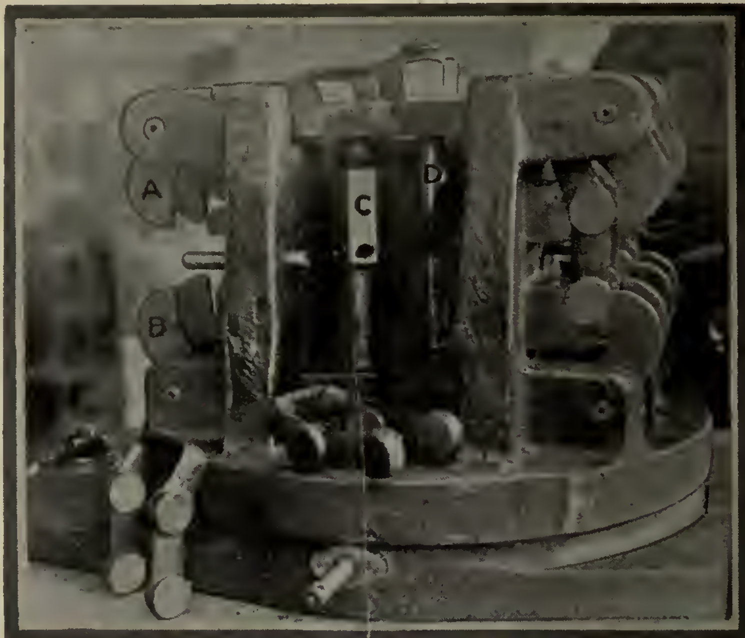


FIG. 2—AN INTERESTING JIG USED ON A LINCOLN-BECKER MILLER.

Sample Examples

The first of these, Fig. 1, illustrates a fixture used on a Ford-Smith Miller. The operation is known as milling the brake support spring bracket, and consists of milling both faces on these brackets.

The fixture is so arranged that it revolves in this way, coming under the classification of a semi-continuous milling fixture.

While the machine is performing its operation at A, the operator is unloading, or loading, at the other station B. In this way lost time is reduced to a minimum. The rest of the fixture is so self-apparent that no comment is made. Four pieces are accommodated on the jig at one time.

Another fixture on the same principle is illustrated at Fig. 2. This operation is known as milling the rear spring shackle. The work is accomplished on a Lincoln-Becker miller, with a gang of eight cutters. As before, four pieces are accommodated in the jig, four cutters being used on each shackle. Attention is called to the novel method of gripping the work. Serrated jaws, A and B, etc., are operated on the fulcrum principle, holding the shackle firmly in position, the tightening being accomplished by two centre studs, as shown at C and D. To allow readers to form a clear conception of the shackle itself, we have placed two in the foreground of the photograph.

FIG. 1—MILLING FIXTURE FOR BRAKE SUPPORT SPRING BRACKET.

A Duplex Fixture

The next fixture illustrated at Fig. 3 represents a rather unusual milling arrangement on a Garvin duplex miller, the operation performed being that of milling the two pedal shaft bosses on the transmission gear case. Only one boss is shown at A, the other being on the other side of the case. The case is held by means of a quick action clamp, operated from the handle B. Here is an example where it paid to install a duplex machine, to accommodate the work, finishing at one set-up, rather than placing on a regular type machine, with two set-up's. Greater accuracy is also obtainable with a machine such as shown, for with two set'up's on an ordinary miller, the workman might possibly fail to clamp the work accurately, throwing the two faces out of alignment. When purchasing machinery of any nature, it pays to thoroughly study your problem.

The remaining photograph is shown at Fig. 4. In this case the work is of a very light nature, therefore placed on a small Pratt & Whitney milling machine. The operation is that of cutting the keyways in the taper end of the rear axle shaft, and advantage is taken of this taper for clamping purposes.

No actual clamps are used, the taper on the shaft providing its own clamping surface. The fixture A is provided with two taper holes, of similar taper to that on the axles. The method of loading the jig is self-evident. The axles are placed in these taper holes, and the operation commenced. The action of the milling cutters pulls the axles up securely into the holes, thus holding the work securely. As can be noted, two axles are accommodated in the fixture. This is an example where extrem simplicity can be combined with efficiency in the designing of any fixture of similar nature.

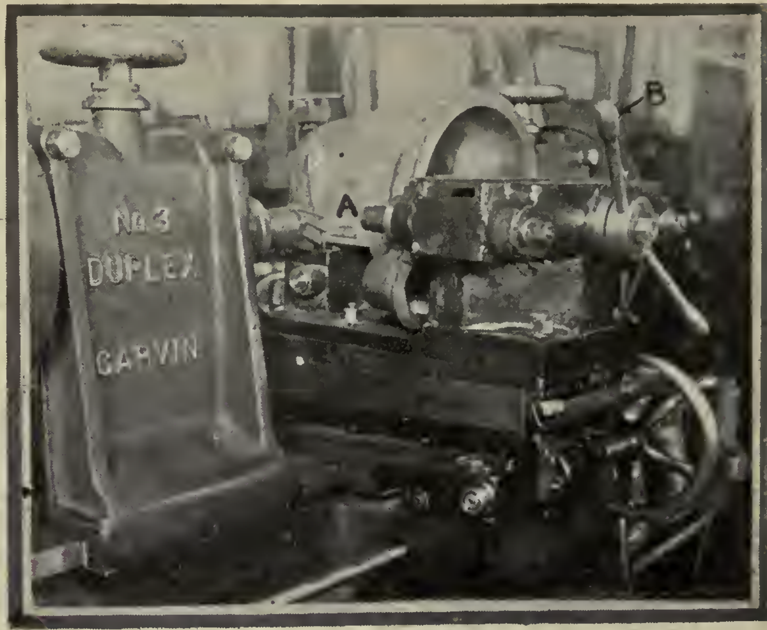


FIG. 3—AN EFICIENT DUPLEX MILLING FIXTURE.

A NEW PLANT FOR TORONTO

The Canadian National Carbon Company, Ltd., and the Prest-O-Lite Co. of Canada, Ltd., have jointly purchased the westerly ten acres of the property at the south-west corner of Bathurst and Davenport Road in Toronto, as a site for a large new manufacturing plant.

The new plant, which is to be erected at once, will consist of two buildings, one of which will be 80 feet wide by 400 feet long, two storeys high, with one section 80 x 80 three storeys high, to be occupied by the Canadian National Carbon Company, Ltd., while the second building for the Prest-O-Lite Company will be 80 feet wide by 400 feet long and two storeys high.

The heating plant will be housed in a separate structure, 50 ft. x 60 ft., and will have room for installation of additional boilers for future units to be added.

All the buildings will be of reinforced concrete frame, flat slab floors, mushroom type columns on 20-foot centres, steel sash and brick curtain walls.

Each building will have two freight elevators, and all toilet accommodations and stairways will be contained in towers erected outside of buildings, thereby removing any obstructions which might interfere with manufacturing operations.

Arrangement is provided for special rest rooms for female employees, shower baths, a dispensary with competent medical attendant to look after any injuries to employees, restaurant with modern equipped kitchen, in charge of a competent chef, where meals will be cooked and served to employees at bare cost.

It is expected that the plant will be ready for occupancy in May, 1920, and everything possible will be done to get it ready by that time.

At the present time the two companies are operating five plants at different locations in Toronto, but owing to the large demand for their goods have been unable to fill orders for some time past, and propose now to get facilities which will enable them to take proper care of their customers.

Mr. R. H. Combs, who has been general manager of the Prest-O-Lite Company for the past three years, and who was also recently appointed general manager of the Canadian National Carbon Company, states that his companies expect to employ about five hundred people as soon as the new plant is ready to operate, and that the facilities provided by these first two units will take care of upwards of 700 employees if needed. "We have secured enough ground," said Mr. Coombs, "to enable us to put up six such units as the two which are now being built, but before adding new units, both the present units will have a third storey added as the buildings are being erected to carry three full floors."

In addition to the large plant described, Mr. Combs states that the company will erect in the spring a new acetylene gas plant in Toronto or immediate vicinity to take care of the greatly increased demand for compressed Prest-O-Lite gas for welding and cutting, and that a large new storage battery warehouse and assembly plant will be erected at Winnipeg.

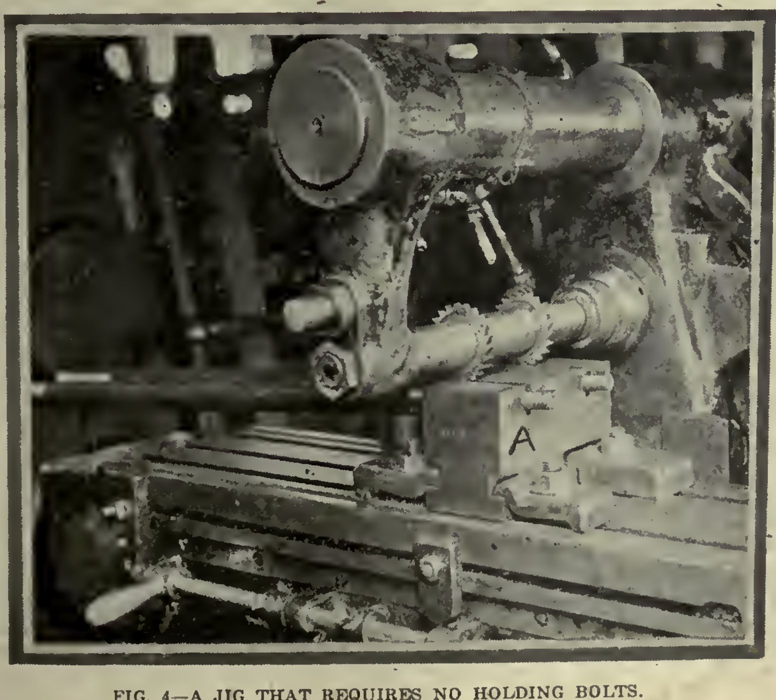
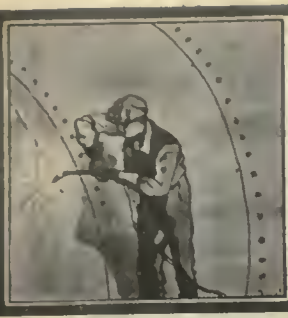


FIG. 4—A JIG THAT REQUIRES NO HOLDING BOLTS.



WELDING AND CUTTING

Fusion Welding Applied to Drop Forgings *

By S. W. MILLER

In connection with the application of fusion welding processes to drop forging, a number of questions have to be considered before a decision can be made as to their use. The principal ones are as follows: First, can any fusion process be applied; second, if so, what process should be selected; third, will a forging reclaimed by welding be satisfactory to the customer; fourth, will a welded forging give as good results as one not requiring welding; fifth, will the cost of welding be greater than that of a new forging? It would appear clear that the answers to some of these questions are not within my province, as I cannot decide, for instance, whether a welded piece, no matter how good the job was, would satisfy the customer, nor can I decide as to the relative costs of welding pieces and new forging. What I propose to do, therefore, is to merely present my ideas as to the possibilities of producing certain results by welding. I am not concerned with the third and fifth questions.

There are two methods of fusion welding which are applicable to the repair of drop forgings. Each one has its peculiarities, limitations, and advantages. They are the oxy-acetylene and the metallic electrode or (electric). The melting temperature is maintained in the former case by the combustion of acetylene in the presence of oxygen, which gives the highest flame temperature known, about 5,000 deg. Fahr. In the second method the melting temperature is obtained by using the electric arc drawn between a metal electrode and the pieces to be welded. The temperature of the arc so formed is higher than that of the oxy-acetylene flame.

I believe it will be generally found that the oxy-acetylene process is more applicable to the reclaiming of drop forgings than the electric, especially where the defects are small, because, while the electric process is considerably cheaper (the cost of operation being only about half that of the oxy-acetylene), yet there is greater liability with the electric process.

Characteristics of the Two Methods

In order to make clear the effects of welding, it should be considered that the heat of the welding flame or arc is very high and that there is a strong tendency to burn out, both from the welded piece and the weld itself, such elements as carbon, manganese and silicon, so that the weld is usually of very different composition chemically from both the original material and the welding rod. A material commonly used for oxy-acetylene welding is steel wire containing about 0.10 per cent. carbon, 0.15 per cent. manganese, and phosphorus and sulphur less than 0.04 per cent. These may be considered the usual maximum figures, although there is considerable variation in different welding wires. For special purposes other wires may be used, and some of these will be considered later. With the above wire, the carbon will be reduced in the weld to about 0.05 per cent., the manganese to about the same amount, while the sulphur and phosphorus will remain about as they were, so that such a weld is a quite pure iron casting. If properly made, the weld material will have an ultimate strength of about 52,000 lb., a yield point of about 25,000 lb., and an elongation of about 20 per cent.

The chemical composition of wires used for metallic electrode work (electric welding) varies widely. One of the best contains about 0.15 per cent. carbon, about 0.50 per cent. manganese, and sulphur and phosphorus not over 0.04 per cent. each. In passing through the arc in the form of a vapor as it does, there is naturally a great opportunity for the metal to lose its carbon and manganese and to become oxidized. Such metal in the weld will contain about 0.03 per cent. carbon and about 0.2 per cent manganese, the sulphur and phosphorus being practically unchanged. Its tensile strength will be about 55,000 lb. per sq. in., the yield point nearly equal to the tensile strength, and the elongation about 3 per cent.

The effect of the heat on the material being welded is different also in the two processes. With the oxy-acetylene method, the temperature is not so high nor is it so local, the results being that the heat effect extends a greater distance from the weld, and, as the heat has to be applied longer, the coarsening of the grain near the weld is greater than with the electric method.

The quality of material being welded should also be considered. If it is a plain carbon steel, the higher the carbon content, the greater the injury, by welding to its physical characteristics. The writer's experience leads him to believe that material up to about 0.5 per cent. carbon can be satisfactorily welded, provided it is properly heat treated to remove the grain coarsening. By this he means that there is no permanent damage to the material. He does not mean necessarily that the welded piece will be satisfactory, even if the weld be sound. This is a matter that will be considered later.

It is, therefore, evident that three things have to be considered in deciding as to the quality of a welded piece: First, the effect on the piece itself; second, whether the weld will be sufficiently strong and otherwise suitable, and third, whether heat treatment can be applied to improve the qualities of the welded piece and the weld. The answers to these questions evidently depend on the results desired.

If heat treatment is to be applied, some consideration should be given to the effect of this heat treatment on the welded piece and the weld. In an examination of the effect of such treatment on oxy-acetylene welds made in material containing about 0.18 per cent. carbon, the writer found that there was a difference of about 300 deg. Fahr. between the refining temperatures of the material and the weld, the latter being made with wire of the composition above referred to. This is accounted for by the difference in carbon content, and also by the fact that the weld is a casting which requires a higher refining temperature than a forging of the same carbon content in order to obtain the best results. Therefore, when welding material of this kind is used, a double heat treatment is necessary, a high temperature, about 1,700 deg. Fahr. for refining the weld, and a lower one, about 1,450 deg. Fahr. for refining the original material. It would seem advisable from this to provide a welding material which in the weld will require the same refining temperature, and which would have the same physical characteristics as nearly as possible as the material being welded. Whether this is possible or not is a question which has never been decided to the writer's

*A paper presented before the sixth annual convention of the American Drop Forge Association, Pittsburgh, June 14. The author is proprietor of the Rochester Welding Works, Rochester, N.Y.

knowledge. It would depend largely on the nature of the original material. It would appear possible to increase the carbon in the welding wire so that in the weld there will be the same carbon content as in the piece, but another difficulty is introduced, which is a practical one. Such welding material is difficult to handle, and unless extreme care is used, the weld will be full of laps and oxide films, and it will be more dangerous than one made with low carbon material. Of course, careless welding with any material will make laps, etc., in the weld. Another solution may lie in the direction of using alloy steels, such as vanadium. These make welds free from oxide, and in which the carbon is largely preserved, but they are, unless annealed, exceedingly brittle. As a matter of fact there has never been sufficient demand for such materials to warrant any research in connection with them, but the writer feels that the time is at hand when this and similar investigations will have to be carried out.

As illustrating the effect of heat treatment, part of a weld was heated to 1,550 deg. Fahr. quenched in oil, drawn at 800 deg. Fahr. and cooled in air. The weld, of course, contains less carbon than the material welded, so that more ferrite is shown in the weld, but it is easily conceivable that for certain purposes such a weld would be entirely satisfactory. This is an illustration of the line of investigation that must be followed in order to determine whether welding in any particular case may be permitted.

Effects of Heat Treatment

It has been found that the heat treatment such as outlined above increases the ductility of sound oxy-acetylene welds made with ordinary materials. Of course it cannot improve defective welds. More work will be required to determine the amount of improvement, and in what directions it takes place, not getting thorough fusion at the beginning of the work. In other words as the arc is drawn between a rather heavy mass and the electrode. the former requiring some time to be brought to the fusion point, the beginning of the weld is liable to be imperfect, while with the oxy-acetylene method the piece can be brought to the melting point before any metal is added, thus insuring thorough fusion. These points then should be considered in deciding which process should be used. There remains for discussion, therefore, only the fourth question, which refers to the quality of the weld itself and the effect of welding on forging. The more important of these is the quality of the weld.

To begin with, it should be understood that the writer is not advocating and has never advocated, the indiscriminate use of welding processes. His belief is that for many purposes a welded piece is just as good as one that does not need welding, but he also believes that there are many cases where a welded piece will not give satisfactory results, and in those cases he advocates very strongly that the pieces be scrapped. The reason for this lies in the nature of welds. A fusion weld is a casting, and, no matter by what process it is made, and no matter how good it is, and no matter to what heat treatment it is subjected, it cannot have all the qualities of a forging, so that, where a heat-treated casting will not give good and safe results, a welding process should not be used.

It is known that nickel increases the tensile strength of oxy-acetylene welds, but at the expense of ductility. Welds made with such material are also liable to contain numerous gas pockets probably due to the nickel present.

With regard to electric welds, the writer has not yet found it possible to improve their elongation by any method of heat treatment. The large amount of nitride of iron present in such welds does not seem to affect their strength because they rupture along the grain boundaries, even when there is no appearance there of any oxide or nitride films under the highest power of the microscope. The writer believes that such intergranular brittleness is due to ultar-microscopic films of oxide of iron, and is not aware of any way of eliminating these at the present time. It also does not seem to make any difference what material is used for electrodes. This problem will undoubtedly be solved, but it will take time and patient investigation.

Electric welds are also subject to defects, but clean electrodes and careful welding help to eliminate them.

Less Successful With Alloy Steels

With regard to the welding of alloy steels, the writer has very little information. In his shop he has not found good results in the few cases in which he has used it. It is evidently foolish to expect that a chrome nickel-steel heat-treated forging can be satisfactorily welded, even with the same material as that of which the forging is made, and, owing to the sensitiveness of alloy steels to heat treatment, he is at present very dubious of the results.

The question of cost enters into all this work to a very large extent. It might pay to repair drop-forged automobile axles by any welding process because of the expense of the forging, while it certainly would not usually pay to repair a small lever. Also the results in the case of the axle would be entirely satisfactory where, for example, a corner of one of the spring pads did not fill out in the die, because there is a surplus of strength at that point, and in the writer's shop similar repairs have been frequently made by both processes. Axles broken in the middle by collisions have been welded and many other repairs have been made which are considered perfectly safe and which have never given any trouble in service.

There is one thing which the writer would strongly urge, which is that those responsible for the welding made sound welds. It is rather remarkable how few welders, according to the writer's experience, are capable of doing this, and he has found that even welders who are supposed to know how to do good work have never been trained to make reliable and uniform welds. As illustrating this, the writer knows of one test in which two welders of more than ordinary ability and experience welded five test pieces each. The average tensile strength of these ten pieces was somewhat over 46,000 lb. (not per sq. in.). An examination of the fractures showed lack of proper fusion and other imperfections which accounted for the low strength. Another welder who had been specially trained then made a test piece with the same welding material, which broke at 56,000 lb., the weld being free from imperfection. To show what can be accomplished, the writer has a record of 15 welds made in ½ x 3½ in. material, the test pieces being machined all over, which gave the following results:

	T.S.	Y.P.	Elongation in centre in. P.C.	Elongation in 5 in. P.C.
Maximum	53,300	37,100	28	26
Minimum	50,600	32,100	17	10.6
Average	51,900	33,180	23	15.6

As showing what can be done with somewhat better welding material, the following are the averages of three pieces made under the same conditions as before:

	T.S.	Y.P.	Elongation in centre in. P.C.	Elongation in 5 in. P.C.
Average	53,100	37,600	31.1	20.7

Foreign Matter Impairs Results

In making electric welds, the conditions are such that it is difficult to get them free from films of oxide, slag pockets, etc. It must be remembered that everything in the electrodes goes into the weld, and if the electrode is imperfect and contains slag and dirt, the weld will also contain these same impurities. Further, the tremendous oxidation undergone by the iron as it passes through the arc is detrimental to the quality of the weld. This does not mean that this method of welding is not suitable for many purposes, because it is, and is successfully used. The writer uses it every day for such purposes as filling up holes that have been drilled wrong, for filling up worn key seats, for replacing metal where too much has been removed in machining, and in many other places where its use is entirely satisfactory.

The advantages of the electric weld are its low cost and the speed with which it can be made. Its principal disadvantage has been referred to before, and that is its brittleness. There are many places where this is not detrimental, and if there is enough suitable work to warrant the installation of an electric welding outfit, its use will be found economical. One matter which should be watched closely in connection with electric welding is the effect of the high temperature and its sudden application to steels containing 0.4 per cent. carbon.

To be continued

Wants Oil Pump.—S. Zographakis, of the Hellenic State Trade Commission, Drummond Building, Montreal, has an inquiry from Greece for the installation of a small oil engine pump assembled.

WHAT OUR READERS THINK AND DO

Another Comment on Recent Letter by H. H. J.

We Would Especially Like to Hear From Foremen or Superintendents on This Subject, as So Far We Have Heard Only the Workman's Side of the Question

REFERRING to the letter from H. H. J. in your issue of December 18, and to the answer to that letter in the December 25 issue. I should like to give you my own views on this subject.

To come straight to the point, I may say at once that I agree both with H. H. J. and with the writer of the second article.

Naturally I cannot give you my own name for publication as it might result in my losing my position, so I will elect to be known as H. A. S., which might mean, "Here's Another Story."

Taking H. H. J.'s letter first, I think he is undoubtedly exaggerating when he says that practically none of the shops in Toronto give the young man a proper show. At the same time, while I do not think that they are all as H. H. J. describes them, I do believe a considerable number of them fail to treat their apprentices fairly. Perhaps the discussion does not really concern apprentices but as I have almost finished my time and can thus still be classed as one, it is this side of the subject that most interests me.

To illustrate my contention I will mention the case of a friend of mine who had started in as an apprentice machinist and in due course was put on a lathe to learn its operation. Being a smart, industrious fellow he soon mastered the work and asked to be moved to another machine. The boss, however, refused to move him and told him to remain where he was. This, naturally, did not suit my friend so he went to the superintendent and again asked to be changed to another machine. "What did your boss say?" was the superintendent's query. My friend told him and at once received the abrupt reply: "Then stay where you are and be satisfied."

A few days later he decided to make an application still higher up and so he interviewed the manager. The latter, who was quite a decent type of man, called in the superintendent and asked him his reasons for refusing to change the young fellow over to another machine. Imagine my friend's surprise when he heard the reason given as follows: "B's a good man on that lathe and has learnt the work he's on thoroughly. Our production is better than ever since he has been in the work, so why change him for someone who may only spoil all our work?"

The manager hummed and hawed at this, but my friend did not get moved and so had to quit to seek other fields. Why? Was it because of lack of ability? On the contrary it was rather the reverse, which goes to prove, as H. H. J. says, that it does not pay to be too good at your job. Here is a case in point where to my mind an ambitious apprentice got a raw deal and could not help himself. As he said: "I went in to learn the machinist trade complete, and not merely run a lathe." This case happened not in some far-away town but right here in Toronto.

I know of another case in which another friend of mine went into a Toronto firm to learn the drafting business. He was getting along extra well and had been highly complimented on his progress, when suddenly he was asked to get out at two weeks' notice. He had a contract but not for any stated period. Naturally he was discouraged and asked why he had to go. It took him some time to find out, but at last he heard that a returned soldier was being brought in, at no cost to the firm, as the Government was paying him, and because of this another ambitious young fellow had to step aside. So disgusted was he that he started to work in a garage at ordinary and everyday repair work, while if he had been given a proper chance he might some day have been a good tool designer.

Lastly, I would like to add a personal instance to this letter and tell a story about myself. I, too, am in the drafting business, and, as stated before, almost out of my time. I have tried earnestly to deliver the goods, have read CANADIAN MACHINERY for many years, and found it helpful in various ways. To put it in another way, I have not wasted my evenings reading useless trash but have read only good, technical matter.

The result is that I have been given good work by my chief draftsman, who is a prince in every respect, but here comes the rub.

His superiors are by no means of the same calibre, as the following incident will show.

"Harold," says the chief the other week, "I'm going to give you a real good increase at once, for you really deserve it." "Thank you," I said, and looked in my next envelope for the extra salary, but, alas, only two dollars a week was added. I was very much disappointed. If this was the chief's idea of a good increase I had another opinion..

My suspicions, however, were all wrong, for the chief came to me of his own accord and said: "Harold, I'm sorry but the manager would not stand for any bigger increase. I told him of your ability, but it did no good. My advice to you is to finish out your time with me, then get out. In the meantime I will show you all I can."

Imagine these words coming from a chief, who, fine fellow as he was, had not the power to fix the value of his men under him. All this in Toronto, where the young man is suppposed to get a show.

In conclusion, the member of your staff who wrote the answer to the first letter is right in this respect, that even if conditions are such as I've described them, we should not lose heart, but plug away, for time will, I positively believe, alter these conditions. The young man's value is beginning at last to be realized in many plants, so here's hoping for the day when the fellow who really is willing to work will get a fair chance.

REPLY TO A QUERY

CANADIAN MACHINERY a short time ago received the following query: "Can you tell us how to roll flat stock from round wire of all sizes from No. 1 to No. 12. Our rolls are ground true and parallel, and are set with opening parallel guide on entrance side of rolls and set square with rolls both ways, also a close fit for the wire. The wire is cut and straightened to lengths, with no guide on discharge side of rolls. The flat stock will not come out straight, and light or heavy reduction in thickness seems to make no difference. Can you solve our problem?"

CANADIAN MACHINERY at all times endeavors to answer their reader's queries, so we got in touch with one of our correspondents who is well familiar with this line of work. Following is his answer:

Answer to Roll Query

Rolls for reducing small, round sections, such as making round wires into flats, should be made in the regular type of rolls for making flat iron or steel bars—having grooves and tongues. The sides of the groove should fit the wire tightly when it is inserted in the first pass. This prevents the wire from spreading and also prevents it from rolling over in the pass. The wire being prevented from spreading sideways, the metal is made to deliver straight as all the work on the metal is exerted at a right angle to the direction of rotation, providing that the rolls are parallel both axially and horizontally and the guides set correctly.

There also should be a close-fitting guide on the discharge side, the latter to be about 18 inches long and having a top piece to keep the metal down as it leaves the rolls. To keep such small, thin sections straight while they are hot, it is best to have them run from the rolls into a narrow trough. Referring to Mr. Leeman's difficulty in getting the rolled wire to come out straight on the discharge side, the writer would say that rolling small narrow sections on plain both sideways as well as at a right angle to the direction of rotation.

The metal spreading in two directions at the same time makes the bar take a curved path, it being difficult to get straight bars under these conditions, especially when their cross section is round. Would suggest that you have a narrow and long guide on the discharge side of rolls, also keeping both the entering and discharge guides as tight as practicable.

See if one of your rolls is crossed from an axial standpoint, as one neck may be worn more than the other; a 1-64 of an inch crossing would curve the metal leaving the rolls. If there is any room between the housing and bearing brasses put a small tin liner on the side toward the curve of the bar, the object being to cross one of the rolls as to cause the bar to straighten up as it leaves the rolls. If any further difficulties are encountered the writer would suggest that you consult your roll-turner, as, being on the ground and knowing the conditions that obtain in your mill such as regards engine power, diameters of rolls, methods of heating and handling the rolls, all of which factors have a most important bearing on rolling problems and also difficulties encountered. The man on the ground can, as a general rule, work to better advantage in overcoming difficulties than a person six hundred miles away, as he is familiar with the working conditions in the mill. In conclusion, will say that for the general run of rolling small sections that cool quickly, grooved rolls will be found to be superior to all others and give the best satisfaction.

Another thing that has a most important bearing upon the curving of small bars which lose their heat quickly is to keep the metal when it goes from the furnace to the rolls from touching any floor plates, as in the latter case the cold part of the bar resists the rolling pressure more than the hot part and makes a curved bar.

LAMP BRACKET FIXTURE

By G. Barrett

CANADIAN MACHINERY readers will no doubt be interested in this fixture to turn automobile lamp brackets on the lathe. These brackets are of malleable iron and were usually done by a box tool on a drill press and threaded with a threading attachment, but proved to be a very poor job.

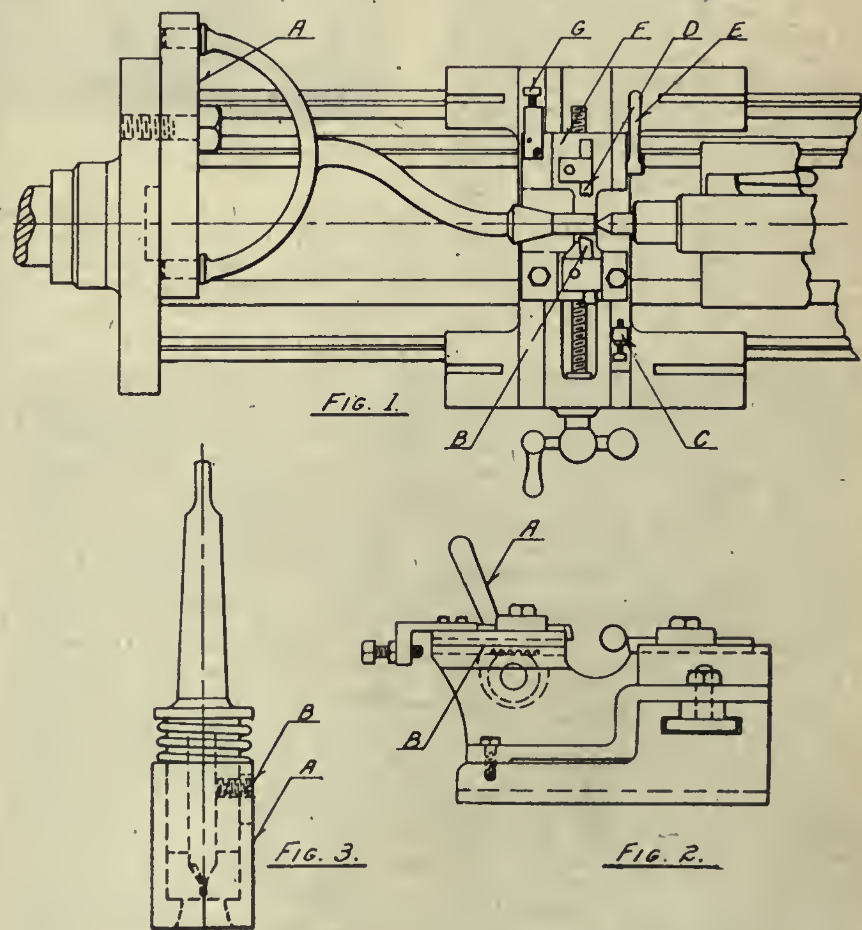
The bracket shown in view Fig. 1 is first centred in a drill press by using the centre drill Fig. 3, which needs little explaining, as the reader will see by placing the lamp bracket with the two ends located in the tee slots of drill table, then pulling down drill spindle till the bush A comes in contact with the end of bracket to be centred. This bush is made to slide on the drill shank and has an elongated hole at B which is to allow for tightening the grub screw to hold centre drill, also keeping sliding bush from falling off through the tension spring.

Fig. 1 shows plan view of bracket ready for operation, which is turning and threading the parallel end. This bracket is driven by a spiral plate A, Fig. 1, which is clamped to the face plate, the turning and threading fixture is bolted to the cross-slide, and the bracket is turned by the tool B, then the cross-slide is brought forward to a stop C, this bringing the chaser D to its working position. The threading is done by placing the feed nut in mesh as in ordinary screw cutting, and pulling on lever E till the rear slide F comes to stop G.

This tool slide, which carries chaser, is shown more plainly in the enlarged side view, Fig. 2, and it will be seen that the slide is brought forward by the lever A, which works on to a shaft, this shaft having a pinion keyed in the centre to mesh in small rack B which is fastened to the tool slide by small fillester screws.

The operation is very simple and is done by a specialist, and no doubt there are lots of other jobs around the country in which a fixture like this would be used to advantage.

Brockville Has New Industry.—Early in the spring, J. Gill Gardner, president of the Board of Trade, will erect a new foundry in Murray's Fields. It will have are lots of other jobs around the country in which a fixture like this would be used to advantage.



ASSEMBLY AND DETAILS OF THE FIXTURE.

DEVELOPMENTS IN SHOP EQUIPMENT

ALL-GEAR DRILL PRESS

The Danber-Kratsch Co., of Oshkosh, Wis., have recently placed on the market a new upright drill press, known as their "Wisconsin" 20-inch All-Gear Driven Upright Drill Press.

The machine is shown in the accompanying illustration.

As will be seen from the cut, the old type of cone drive has been discarded and replaced by a geared head single pulley drive. This eliminates all shifting of belts to get the different speed changes required. The drive for the machine consists of four pairs of semi-steel and rawhide gears. These gears are engaged or disengaged through friction clutches by means of the single operating lever on the left-hand side of the machine. There are no sliding gears in the gear box, so that the speeds may be instantly changed from one to another, without shock or jar, by a single movement of the clutch lever, while the machine is running at full speed. The clutch gears in gear box are mounted on roller bearings, so that it is unnecessary to run gears in an oil bath. The end bearings of gear shafts are bronze bushed, and are lubricated from the outside by means of oil cups. The drive from gear box to spindle is through a pair of bevel gears.

The column is reinforced by the straight back-strut, which supports the back end of the gear box, and also relieves the column of all bending stress induced by the pressure of the drill. The lower cylindrical end of the column is ground to carry the table support.

The base is made heavy enough to properly support the machine, and also provides space for any work to be drilled on it. Base has two Tee slots for bolting work to it.

The table support is made in the form of a box section. This is clamped on the column by a single clamping screw, operated by means of a hand lever. The table has four Tee slots. The centre hole in the table lines up exactly with the drill spindle, so that a boring bar may be used in spindle, if desired, for boring large holes. Table is clamped in its support by a conveniently-located hand lever. The elevating screw, for raising and lowering the table is placed at the back of the machine so that the table may be swung at right angles, entirely out of the way of the column on either side, for drilling work on the base.

Both table and base are provided with large oil trough for properly taking care of cutting lubricant. Balance weights for both spindle and sliding head are placed between column and back-strut, and run on guides, so that they are easily accessible. The machine is equipped with a sliding head and all-geared power feed. Also has handwheel feed and a large pilot wheel for quick return of spindle or sensitive feed for small drills. The spindle is made of high-carbon steel, and has ball thrust bearing at its lower end. It has four changes of feed for each spindle speed. There are four spindle speeds on the machine shown. If desired, a two-speed friction counter-shaft may be furnished, this giving eight spindle speeds.

ALL GEAR DRILL PRESS.

All gears used on the machine are properly covered to keep out dirt and to protect the operator. Machine may be equipped with tapping attachment, if desired.

STRAIGHTENING MACHINE

The W. J. Pine Machine Co., of Kenosha, Wis., have placed on the market a machine which they believe to be a new departure in the machine tool line. Every user of cold-rolled steel knows the difficulties they have to contend with in its use. It is full of kinks and twists, and the usual method employed is to hammer the convex side of a kink to drive it in, but this only draws the grain on the long side longer, and if the kink is reduced at all there must be additional kinks of lesser degree. It is impracticable under present methods to use cold-rolled flat or square stock, where one edge or side is to be broken the full length owing to tension of all surfaces which, when broken, causes the stock to bow. Cold-rolled flat stock could be used to advantage for a great number of purposes where it is now impractical, if a practical means for straightening were at hand.

With this machine devices are at hand for doing this work in the only way practical, that is by pressure on the long side of a kink which contracts the long grain and expands the short grain.

The upper bar is a testing table on which stock is laid to find the kinks; it is then placed under the pressure screw, which is convenient for the purpose, as illustrated in the photograph. When used to take the twist out of stock, one end is clamped on the parallel under yoke vise, and the other end in the twisting head vise.

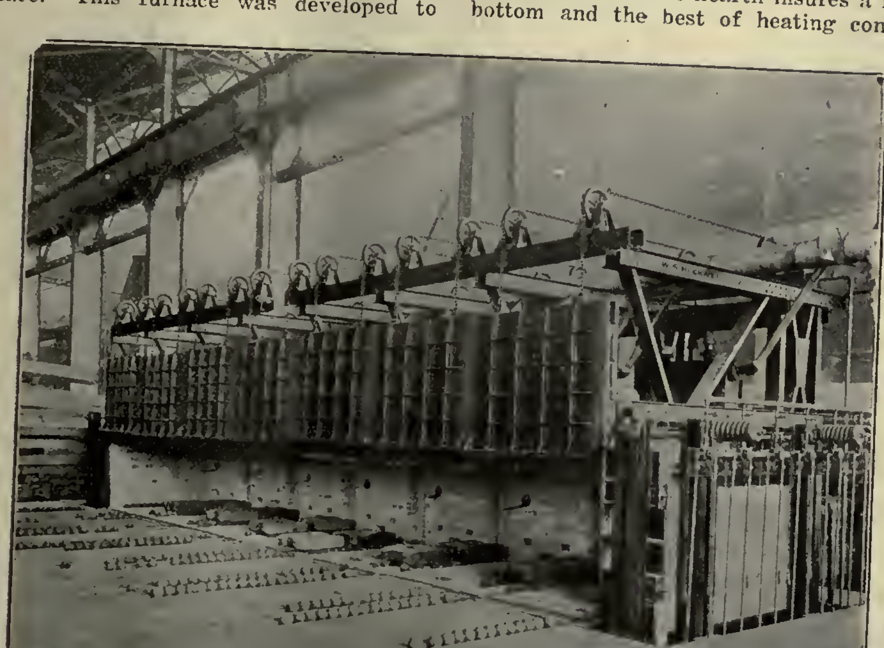
The machine provides a convenient means for doing innumerable operations that come up in machine shops in general. Such as offsetting connection rods and bars, bending irregular shapes in forms or dies, where pressure is used. Four sizes are being built which apply mainly to the length of the testing table. The four sizes with their principal specifications are as follows:

VIEW OF STRAIGHTENING MACHINE.

	Number 1	Number 2	Number 3	Number 4
Length—Testing Table	6 feet	8 feet	10 feet	12 feet
Width—Testing Table	4 inches	4 inches	5 inches	5 inches
Hand Wheel—Diameter	18 inches	18 inches	18 inches	18 inches
Straightening Screw	1⅛ x 12½ inches	1¼ x 12½ inches	1⅜ x 16 inches	1⅜ x 16 inches
Straightening Table	16 x 8 inches	16 x 8 inches	20 x 12 inches	20 x 12 inches
Vise Jaws	1½ x 4 inches	1½ x 4 inches	2 x 5 inches	2 x 5 inches
Distance between Centers	4 feet 8 inches	6 feet 8 inches	8 feet 8 inches	10 feet 8 inches
Approximate Weight	750 pounds	900 pounds	1200 pounds	1400 pounds

SIDE-OPENING FURNACE

The W. S. Rockwell Company of New York, have placed on the market a new type of side-opening, heat-treatment furnace. This furnace was developed to heat treat material varying widely in shape and size.



FRONT VIEW OF UNDERFIRED SIDE-OPENING HEAT-TREATMENT FURNACE, SHOWING ONE DOOR OPEN.

This furnace is 36 ft. wide. Stock approximately this length may be placed in the furnace for heat-treatment, or the furnace may be partitioned off into individual chambers 5 ft. 9 in. wide or multiples thereof. Thus, while one chamber was heating stock say 5 ft. long, the other part of the furnace could be heating stock either much longer than 5 ft. or smaller. The furnace has proved so advantageous in operation that it is now being widened to provide a working chamber 105 ft. wide in the clear, the length remaining the same. This increased width will provide facilities to anneal and heat-treat the largest shafts and similar pieces handled in this forge shop.

The doors can be raised or lowered independently of one another. They are operated by compressed air and counterweights. They are dovetailed and form guides within themselves that prevent the escape of hot gases. The roof is constructed of flat tiles, avoiding the thrust caused by the ordinary arch construction.

Oil or gas may be used as fuel. Combustion takes place in a series of combustion chambers located under the hearth, the hot gases from which pass into the heating chamber in such manner as to insure a uniform application of heat to the material in the heating chamber. The location of the combustion chambers under the hearth insures a hot bottom and the best of heating conditions. Some of the gases in the heating chamber are siphoned back into the combustion chambers, insuring a complete circulation and uniformity of temperature throughout the heating chamber.

The heat in the spent gases is also utilized. The spent gases, as they leave the vents, circulate through the preheaters shown at the rear of the furnace and arranged above the vents. The air in these preheaters thus returns through the burners the greater part of the heat in the spent gases that would otherwise be lost. The fuel consumption in this furnace is extremely low, due to the efficient application of the heat and the utilization of the waste heat ordinarily lost.

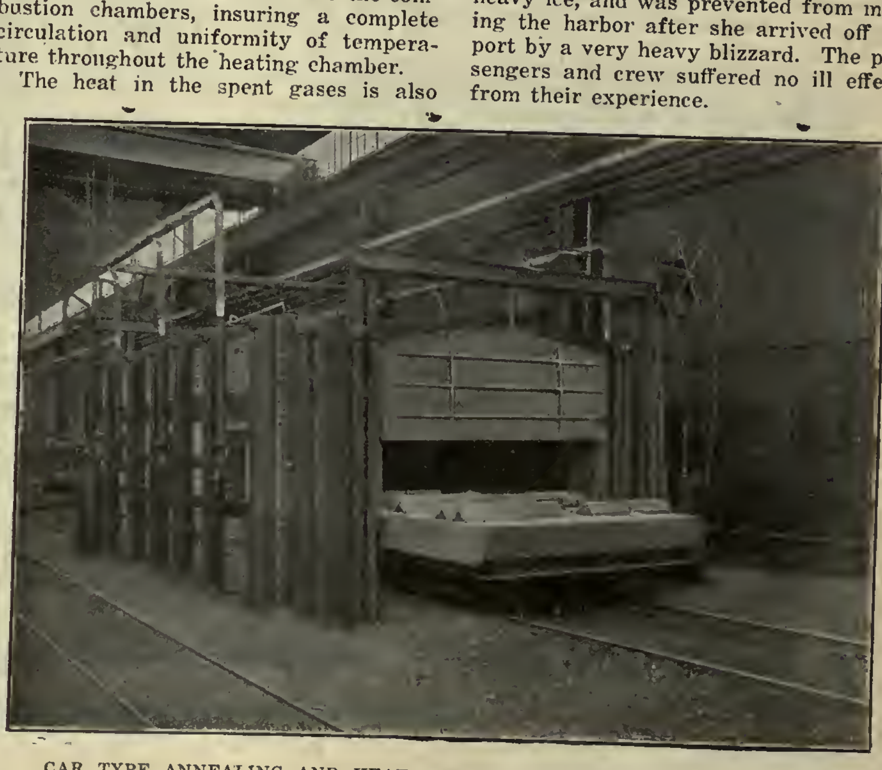
Provision is made for the convenient control of the burners from above the floor level at the rear of the furnace.

Expansion of the brickwork, or of the furnace as a whole, is taken up by heavy springs shown at the side of the furnace. The overhead trusswork has been so divided as to prevent any distortion, due to the heat in the furnace.

If the pieces to be heated are small, they may be placed on the floor of the furnace, or if they are large and rather unwieldy, heavy cast steel trucks may be used, upon which the pieces are supported above the floor level, special provision also being made to take care of the expansion of the pieces within the furnace.

This side-opening furnace is equally good for heating long, fairly light rods. These may be laid directly on the furnace hearth and pulled out one at a time for quenching or other treatment. The doors may be opened only enough to permit of a piece being withdrawn, thus conserving the heat in the furnace. Doors are easily controlled by the air hoist door-lifting mechanism.

MUSKEGON, MICH. — The steamer Petoskey, about whose safety grave fears were entertained, arrived safely at Muskegon, after a very severe passage from Milwaukee. The vessel encountered very heavy ice, and was prevented from making the harbor after she arrived off the port by a very heavy blizzard. The passengers and crew suffered no ill effects from their experience.



CAR TYPE ANNEALING AND HEAT TREATING FURNACE—OIL OR GAS FUEL.

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PRINCIPAL CONTENTS

Something For Nothing

IN THESE days of high fuel costs it is no cause for surprise that consumers will carefully study any means of getting better results from the fuel they use. There is plenty of room for legitimate methods of fuel conservation, the efficiency of the average steam plant being of a very low order. Unfortunately, the situation also gives opportunity to the charlatan who is anxious to benefit humanity by a wonderful preparation, which gives heat value by being merely sprinkled on the fuel. The peculiar part of it is that they are able to not only sell the stuff to supposedly hard-headed, though frequently gullible business men, but to get signed statements claiming that the stuff does what it is supposed to. These quacks and their fuel-saving nostrums appear from time to time in different parts of the country. They flourished a brief space and vanish, only to re-appear far from the scene of their former labors.

The basis of all fuels is carbon. The composition of coal is carbon, hydrogen, oxygen, nitrogen and ash. The proportion of carbon varies with different coals, but may be taken as being from 75% to 90% of the total. The heat value of coal, which means the heat available from the combustion of one pound of coal, is anywhere from 9,000 to 14,000 British thermal units, depending on the relative amount of carbon, hydrogen and ash. Oil fuel has a higher heat value than coal, owing to it being without any ash content. It runs as high as 22,000 British thermal units to the pound.

In a recent case we have seen, the vendor of one of these heating compositions claims, by the use of his preparation, to have raised the heat value of the fuel by 50%, and have lowered the ash content of the fuel. Now the ash content of a fuel cannot be lowered. It is there. What may happen is that some ash will fuse at a lower temperature than others, and a higher proportion of unburned carbon may be carried off by it. Providing that the furnace was working at its best efficiency, the only way that heat could be added to the fuel would be by adding some chemical of a tremendously high heat value. Hydrogen has the highest heat value of any chemical, and that is already contained in the coal, and furthermore, could not very well be applied in the form of a solution. Common salt will make a pretty flame when thrown on the fire, but the added heat is nil. In fact, it will probably extract heat in changing its state. There is nothing to back up the claim of added heat value in the case we mention that would receive any consideration from an enginer. If any one comes to your factory trying to sell a compound that will cut the coal bill in half, insist on him bearing the expense of a properly conducted evaporation test by an independent engineer of recognized ability. If the seller is willing to do this, then enquire into the cost. If anyone buys a cheap compound, or a dear one, for that matter, with the idea he is going to save half his fuel bill, or one-quarter of it, he must be of a high susceptible nature, and a good subject for a gold-brick artist.

The Exchange Situation

AMERICAN firms doing business in Canada have made a very fair move to overcome the handicap to their business by opening bank accounts in Canada.

The business going from Canada was being discounted in payments anywhere from eight to eleven per cent.

The way to overcome this was simple. Open a Canadian account, accept Canadian money at par, in the certain knowledge that the tremendous wealth and resources of this country are sufficient to bring the exchange rate back to normal.

Canadian people do not like to have their money sausage-machined in United States or in any other country.

Canadians feel that there is real security behind their coinage, and do not relish the inference that carrying Canadian bills or silver is nursing a white elephant.

U.S. firms that are opening accounts here, and accepting payments of accounts at pare are showing in a concrete way that they have confidence in Canada's ability to right the exchange situation.

In other words, they have confidence in the common sense of the Canadian people to see that growing more and producing more is their one sure way out.

They have confidence in the common sense of the Canadian people to see that shutting down on production by shorter hours and less effort is going to be a funeral rather than a festival.

Canadian people enjoy the confidence of these U.S. merchants. It is a compliment to the worth and strength of this country to have an exchange rate of from 8 to 11 per cent. waived in our favor.

Canadian people should come right up to scratch and demonstrate fully that this confidence is well placed.

Wet and Dry At Once

IT seems to be the aim of the Governments of this country to please the people. That may be another way of stating that the least government the people have the better for them.

The people of Ontario voted on the booze idea. The result was that John Barleycorn was led to the edge of the village and pointed in the direction of the wilderness.

The Dominion Government, on the other hand, probably heard of the thirsty throats and depleted cellar bar rooms. Hence they make it possible for the Quebec people to reach over and pour booze into Ontario.

Ontario votes dry and goes dry and pleases the drys.

Ottawa makes Ontario wet and pleases the wets despite the 2-to-1 vote.

Give all the people what they want seems to be the slogan nailed to the Government offices in this country.

Beware Working in Closed Garages

By CHARLES C. PHELPS

DID you ever stop to realize that working in a small, closed garage with the engine of your car running is like gambling with death? The newspapers have reported several cases of persons collapsing and perishing under such circumstances before aid could reach them. This should serve as a warning to all car owners. Unfortunately it is easy to forget the warning on a cold winter day when you are pottering around the car and have closed the door and windows of the garage, and have started the engine running, perhaps to secure a little heat from the muffler and radiator.

There is no mystery about the cause of disaster lurking in the closed garage. It is the deadly gas carbon monoxide which is mixed with the exhaust gases from the engine. Even small quantities are disastrous; in fact, this gas formed the principal constituent of one of the worst of the poison gases used in the war.

The U.S. Bureau of Mines recently issued a technical paper dealing with the vitiation of garage air, in which it was stated that air containing as little as one-fifth of one per cent. of carbon monoxide will cause a man at rest to collapse within an hour. Experiments made to determine to what degree air in a closed garage is vitiated by running a four-cylinder engine of 30 horsepower, proved the presence of dangerous proportions of carbon monoxide in the most distant parts of the garage after running the engine less than a half hour, while near the exhaust muffler the air was extremely unsafe after the engine had run 15 minutes. These results were secured with various settings of the throttle and spark.

The worst feature of carbon monoxide poisoning is that there are likely to be no symptoms to serve as a warning. Collapse comes suddenly, while the running engine is constantly making the air still more poisonous; hence everything is in favor of the victim perishing before help could arrive.

Always open the doors and windows of your garage before starting your engine, or better still, take the car out into the open and you will thereby avoid exposing yourself to a very real danger

Production in 1930!

A WRITER, with a rather facetious turn of mind, has a story in a recent number of *Engineering*, in which he describes a motor car being turned out in batches of 10,000 at £50 each. The story is dated 1930, and released for publication now, no doubt, in order that people may hold their automobile orders for the new car.

The manner in which automobile production has been brought to a science, and turning out of parts speeded up to a tremendous rate, also has the tendency to open the door to the writer who sees in this age of specialization the opportunity to lead in the absurd and the ridiculous.

So when the mechanical specialists of the automobile world find writers having their little fling at them and at their work, they will simply have to grin and bear it. Such is fame.

The Business Paper

AN association of railway executives undoubtedly represents the most capable and progressive business men on the continent. Practically all of them have worked their way up from minor positions and they know every phase of labor, business and public opinion. They should know it better than any other class in the community.

Recently the Association of Railway Executives of the United States wanted to lay before the country the fundamental facts of the railway situation. They selected a number of newspapers for this purpose. Out of the total number, 42 were purely trade and technical newspapers.

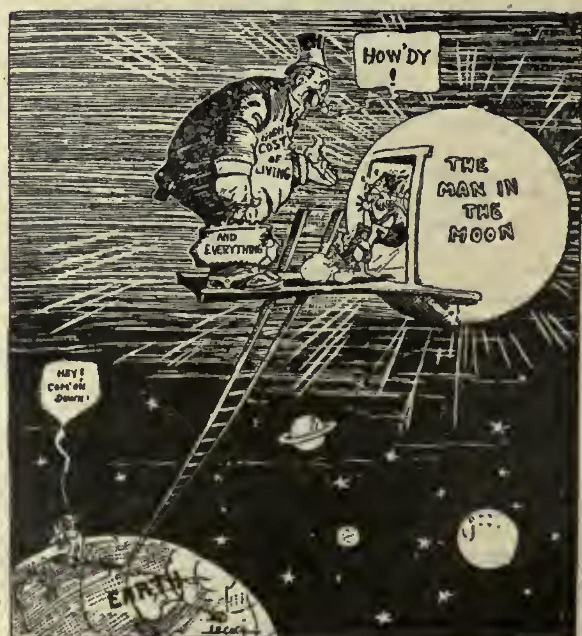
This is one more experience which we commend to the attention of the Dominion Government which employs M. E. Nichols at a bigger salary than he ever earned before, as Director of Public Information. The two daily newspapers which Mr. Nichols directed went insolvent. Mr. Nichols reported and passed his report to the Government that business newspapers were of no public value and were not entitled to admission to the newspaper mails. Should such a man, who is so far behind the times, be retained at such a high salary and in so important a public position?

WHILE going through the fitting shop of a large engineering works the manager noticed an apprentice, who was holding his hammer close up to the head, in an unworkmanlike manner. The manager remonstrated with him in this fashion: "Look here, my lad, that's no way to hold a hammer. When I see a man holding his hammer by the end of the shaft I pay him $30 a week. If he holds it half way up I pay him $20 a week, and when its held higher than that I pay him only $10 a week. Do you get me?" "Yes, sir," replied the youngster; "but you might tell me where I should hold it. I only get $5 a week."

A good way to test a suspected mica plug is to lay it on top of the cylinder after dark, taking care not to have the insulated terminal in contact with any metal parts except the high tension current lead. The engine is then run on the other cylinders and the inside of the spark plug watched to see if sparks jump between the insulator and the plug body, instead of between the points. If a short circuit exists, it will be easily detected by the minute sparks plainly evident in the darkness. It is sometimes possible to test a plug out in the daytime by shading it from the light in some manner, as with a black felt hat.

A new microphone to collect sounds and convey them to the ears of partly deaf persons by almost invisible wires is so compact that it can be worn under a man's necktie.

For the production of cheap electric power, briquettes and certain by-products the Government of Victoria is planning to develop immense deposits of brown coal, estimated to exceed 20,000,000,000 tons.



MARKET DEVELOPMENTS

Prices Show No Tendency of Resting

Increases Marked Up in Several Lines—Big Shipment of Galvanized Offered at 9.50, Brooklyn—Automatic Output Sold Up to February, 1921

A NUMBER of machine tool builders in United States have taken steps to protect their business against the handicap of the exchange rate. They have opened bank accounts in Canada. In this way Canadian payments are accepted at par, and the funds are left here in the meantime or invested in Canadian securities. Payments for machine tool equipment often run into large sums of money and the exchange rate was becoming a serious anchor to the transaction of business.

There seems to be no limit to which the price of material will go. Just this week one Toronto warehousing concern got an offer of 500 tons of galvanized sheets at Brooklyn, the price being 9.50 per pound. To bring this shipment to Toronto would raise the price to very close to 12c, which would mean that the warehouses would sell out at between 13½ and 14c per pound. The material would also have to be inspected, and it might decrease by this process. Compare this with 7.50, the selling price in Toronto as recently as July of 1919, and one has some idea of the trend of prices. The present quotations in Toronto are around 9.50 to 10c, with delivery slow and material very hard to secure.

There is a good volume of business now in almost all lines, such as machine tools, supplies, etc. Kindred lines also report good business. Stock-taking is occupying considerable time just now, and in some places this has been the first opportunity of cleaning out the remainder of the war supplies.

One of the makers of a fine line of automatic machinery has notified Canadian sellers that their present delivery schedule stands at February, 1921, the time in between being fully occupied in turning out business now on the books.

BETTER SUPPLY OF MATERIAL WOULD HELP MONTREAL BUSINESS

Special to CANADIAN MACHINERY.

MONTREAL, Jan. 15.—The ratification of the peace treaty is an event that the entire world has been waiting for for many months, but it remains to be seen whether this incident will have any material effect upon general business. It has been accepted by trading interests generally that the actual passing of the treaty was just a question of time, and manufacturers and dealers here do not anticipate any radical change of existing conditions as a direct consequence of this welcome but long-deferred political consummation.

Greater Production Necessary

The pivot upon which the steel trade swings at present is that of delivery. The prospects for a betterment of this condition lies in the greater production of the mills. For some time past the steel strike in the States has interfered with the operation of many of the mills and dealers here have experienced considerable difficulty in getting material through from American points. This has had the effect of aiding Canadian mills, and reports are showing the greater local activity that has developed during the past several months. Consuming demand is of a steady character and reserve marks many of the steel inquiries. Dealers do not anticipate any marked increased demand as a result of peace but are looking forward to a very good year in all lines of activity. It is generally conceded that impetus will be given to export trade now that the world is again on a peace basis. The gradual adjustment of labor troubles will be the principal factor in greater production and incidentally a lowering of the high prices now prevailing. This latter condition is, however, a question of intensified output and little or no decline is looked for before the early or middle summer. Dealers here are quoting a warehouse price of $4.25 on steel bars against a mill price of $3.75 Pittsburgh.

Improvement Showing in Scrap

The market in scrap has revived a little since the first of the year, but the activity so far is not pronounced. The local trade in foundry business is well maintained but the supply is not large and prices remain firm. Local dealers are better pleased with the prospect of a return to normal trade with the States, but the question of exchange is still a deterring factor. Slight fluctuations have taken place in some lines but quotations are invariably firm and subject to individual sales.

Under the inquiry that is coming to hand there appears a good prospect of a steady improvement in the demand for different classes of machine tools. There is, from time to time, inquiries as to certain articles that can be made here in Canada, and it is presumed that agents of foreign countries are looking about for manufacturers that can take care of their needs. If existing plants are not in a position to handle the particular product required it is not unlikely that, in some cases, factories would be established. A good demand still exists for standard equipment but dealers are often unable to meet the wishes of their customers in this matter of delivery. Considerable business has been done of late by Canadian firms as a result of the exchange rate now prevailing. Supplies are still moving in good volume.

MONTREAL.—It was stated by Maj. P. A. Curry, the new general manager of the White Star-Dominion Line, that there would soon be two new passenger ships on the St. Lawrence route. These ships will be named the "Regina" and the "Rimouski."

STEEL PRICES ARE GOING HIGHER YET

Several Lines Have Been Moved to a Higher Level Since First of Year

TORONTO. — House cleaning and stock taking are among the chief pastimes in the machinery trade this week. There are instances where it has never been possible, owing to the amount of business that has kept coming, to get the war stock all out of the premises. This refers especially to supplies and certain lines of small tools.

There seems to be no let-up to the tendency for prices to go higher in many lines, especially where iron and steel enter into the bargain.

It is no family secret to state that galvanized sheets are scarce. In fact, scarce hardly describes the situation. The scarcity of the article threatens to blow up all the price regulations that have been in force for some time past. If a firm must have galvanized material in order to go ahead, and if that firm is fortunate enough to find some material for sale, then it is as plain as day that they must pay the price. Here's a little happening of a day ago that shows how prices have taken to the upper registers. A Toronto warehousing firm received word of a lot of 500 tons of galnections in Chicago stating that they had received work of a lot of 500 tons of galvanized iron for sale at a certain point near New York. The price on these was quoted at 9.50c per pound, and it was further stated that the sheets had not been inspected. They were a lot that had been left over from a war contract and they might or might not be good all the way through. If a person were to bring these to Toronto and pay duty, freight, exchange, etc., the price would not be far from 11.80 or 12c by the time the deal was over. This would mean a warehouse price of something between 13c and 14c if there were anything in it for the handlers. Buyers who have been over in the States recently say that prices that are being quoted in Canadian warehouses right now are better for the buyer than those asked in the warehouses in the States at the present moment.

Tubes, both lapweld and seamless, took a five per cent. jump, which is now charged to the trade.

The price of plate continues to be quoted about the same, but prices are largely nominal. Buyers do not like to admit that they are paying premiums, but as a matter of fact there is a lot of premium business crossing the line from Canada now. One case that CANADIAN MACHINERY heard of was where a tonnage running into some two or three hundred tons, was placed at 3.25. Of course, for this price there is a correspondingly good service in the matter of delivery, which was promised in 60 days —in reality the promise was a guarantee. Sixty days is not quick delivery as a general thing, but just now it is in the remarkable class.

As long as price is not the determining factor premiums can be easily asked and collected if the material is forthcoming. It is simply a case of passing the increase on to the last buyer. Hence the scarcity is doing its bit in keeping up the high prices.

The Canadian steel mills are booked well ahead. They are not able though, to handle anything like the volume of urgent business that is being offered in the Dominion at present.

The Machinery Market

When it is stated that some of the standard line of machine tools are advising deliveries now of February, 1921, some idea may be secured of the business that is booked ahead. No, we did not make a mistake there. It says February, 1921, and that is correct. However, there are ways known to the trade whereby these dates can often be improved a little for a bona fide and urgent sale.

A number of American makers have taken to the idea, started a week or so of opening a bank account in Canada to overcome the exchange situation. They make it possible for the Canadian buyer to make his dollar buy a dollar's worth, and the arrangement means quite a bit to the customer here, when the present rate of exchange is taken into consideration. American firms found that they were handicapped sc seriously by the exchange situation, and the chances seem to be that there will be more of this done in the future.

A nice volume of business is being done in small tools and supplies, not from any particular concern, but from a wide range of firms. The trade learns that one firm in this district, following extensive tests that are being carried on now, will place business in large quantities in accordance with their findings.

Although dealers as a general thing are not protected by the makers of drills and other small tools, they report a very nice trade in these lines, at their own stock prices, regardless of what the same material can be secured for at the factories. Some of the dealers are having a thorough house cleaning now of what they have on hand, and finding out just where they stand in regard to slow-moving lots. There is little doubt but that a close search will show there is material from the war days in the stock yet. Chances are that the trade will be advised, and a movement forced. If the worst comes to the worst there are some sizes that will make a shipment to the scrap heap.

Turkish emery is once more on the market in fairly liberal quantities, and is bringing a better price than the American product which was in use here during the absence of the Turk stuff. Plating material is coming in fairly. Potassium carbonate, if any is to be secured, sells now at about $1.25 to $1.50 per pound. There were some large stocks of it held in this country when the war started, which were largely brought here from Germany. With the exhaustion of these the scarcity set in. During the war what was turned out in United States was the property almost exclusively of the War Department, and never came on the open market. An improvement in this line is looked for.

An important industrial announcement is that the General Fire Extinguisher Co.'s business will henceforward be carried on by the Grinnell Co. Inc. Both these companies are sufficiently well known in the fire appliance, sprinkler, and steam piping and fitting fields to make description unnecessary. The new company will carry on all the lines formerly handled by the two concerns, including a complete engineering and constructional service for industrial plants.

POINTS IN WEEK'S MARKETING NOTES

Orders have been placed in this district for plate at as high as 3.25 with a sixty-day delivery guarantee. The 2.65 price is still good, but nothing is promised in the way of deliveries at that price.

—

One Chicago firm wired a Toronto warehouse this week offering galvanized sheets at Brooklyn 9.50 per pound. To put them in here would bring them up to almost 12c. They were not guaranteed or inspected.

—

Most of the machinery and supply houses are busy just now taking stock. In several cases this is the first chance they have had to get things in shape since handling war material.

—

A shortage of trained men at some of the steel mills is a factor in keeping down production.

—

Some of the U. S. steel mills are not selling far ahead in the open market, preferring to look after the best of their old customers and employ the rest of their capacity on premium business.

—

Crane manufacturers are booked for some months ahead. Some Canadian business has been placed.

—

It is expected that U. S. railroads will be in the market for equipment as soon as turned over to their owners by the Government.

—

Dominion Bridge, Montreal, is spending a large amount on equipment, one estimate being around the million mark.

CRANE BUILDERS ARE BOOKED UP WITH BUSINESS FOR MONTHS TO COME

Special to CANADIAN MACHINERY.

NEW YORK, Jan. 15. — A remarkably good business is being done in all lines of metal-working machinery. Taking cranes as an example, the business which has been done in the past few weeks has been sufficient to fill up some of the crane shops for months and they are hesitating about accepting much more business at present prices on account of the advancing cost of steel. An Ohio company has taken a very large amount of crane business, including orders from the Algoma Steel Corporation of Canada, the American Rolling Mills Co., Middletown, Ohio, and the Follansbee Bros. Co., Wheeling, W. Va., which is building a new sheet mill at Toronto, Ohio. The Westinghouse Electric & Mfg. Co., Essington, Pa., near Philadelphia, has bought 12 overhead cranes for additions to its plant and will within the near future be a large buyer of machine tools. The Westinghouse Company built its Essington plant during the war to make turbines and auxiliary equipment for the Emergency Fleet Corporation. Since the war the company has branched out into the manufacture of land turbines also, and now it has been decided to consolidate all of the company's manufacturing in this line at Essington. The buildings occupied for this purpose at East Pittsburgh, Pa., will be vacated and used by the company for manufacture of electrical equipment. A part of the machine tool equipment will be moved to Essington, but a great deal of new equipment will be bought for both East Pittsburgh and Essington plants.

Roads Due To Buy

In view of the return of the railroads to private operation on March 1 and the probability that extensive purchasing of rolling stock will be made, it is significant that car manufacturing companies are expending their facilities. Comment has been made in these reports on the buying done recently by the American Car & Foundry Co. for its various plants. Now the Midvale Steel & Ordnance Co. has appropriated nearly $2,000,000 for extension of its car shops at Johnstown, Pa., and about $500,000 of this amount has been expended for machinery, such as forging presses, bolt and rivet machines, punches and shears and machine tools. The American Locomotive Co. still has quite a lot of equipment to buy for its various plants. The American Bridge Co. has recently bought plate-working machinery for its Trenton, N.J., plant, where steel for ships is being fbaricated.

The Dominion Bridge Co., Montreal, Que., has been seeking heavy tools, such as planers, boring mills, etc., in this market, and has made several large purchases. It is reported here that its appropriation for new or used equipment is about $1,000,000.

The New York market has not been extremely active since the first of the year so far as large projects are concerned, but the volume of business in small orders is very satisfactory, and much in excess of what has usually been expected at this season. The Empire Cream Separator Co., Bloomfield, N. J., is about to buy a list of tools to increase its output of cow-milking machines and cream separators.

BELIEVES CONDITIONS ARE DUE TO IMPROVE IN PITTSBURGH DISTRICT

Special to CANADIAN MACHINERY.

PITTSBURGH, Jan. 15. — With pig iron and steel so extremely scarce the matter of production is the chief item of interest in the trade. The indications have become more favorable. Of particular importance is the showing made by the compilation conducted by the "Iron Age" of the production of pig iron month by month. The report for December shows that production in that month was at a rate of 6½ per cent. greater than the rate during November, and the steel works furnaces and merchant furnaces, which are reported upon separately, showed approximately the same proportionate gain. The rate of production January 1, moreover, is shown to have been about 6 per cent. greater than the average rate during December, so that the improvement is progressive. Nor does the improvement stop there, for it is well known that there was a very considerable coke shortage even on January 1, and thus as this coke shortage is gradually relieved production will increase still farther. On January 1 there were some furnaces banked from lack of coke. Others, and quite a number, were running slack, with their insufficient coke supplies, rather than bank entirely. Still others were idle, but merely awaiting a coke supply in order to blow in Supplies of coke have been increasing and it is the common expectation that the supply will be nearly, if not quite, normal before the end of this month. As to the general future no fears need be entertained, for with the many by-product coke ovens built in the past few years, nearly all the old beehive ovens surviving, there are more ovens than enough to make coke for all the blast furnaces in existence. Prevailing coke prices are very profitable, while the average of $11 advance in pig iron in the past seven months makes it that the furnaces could offer still higher prices for coke if further temptation needed to be put in the way of coke operators to make coke and to get the labor necessary to do so.

The remarkably favorable nature of the pig iron report is made apparent when it is recalled that early in December, on account of the acute fuel shortage, it is common expectation that pig iron production in the month would be at a lower rate than in November, while instead of 6½ per cent. increase is now shown. The reason the furnaces did so well in the face of a coke shortage was that during November production was still being restricted by the iron and steel strike. Practically all of the strike had disappeared before the middle of December. The item is of no consequence, but it may be mentioned parenthetically that last Thursday the strike committee met in Pittsburgh and formally called the strike off. Original strikers remaining would be chiefly men whom the employers did not wish to take back on account of nationality, ignorance of the language or disposition to make trouble rather than do good work.

Another favorable indication as to steel production in this quarter of the year is that in the past ten days the valley steel mills have been large buyers of heavy melting steel scrap. for deliveries over 60 to 90 days, when movement in scrap market just before the holidays had been supposed by dealers to have represented about all the scrap the mills felt they would need for the quarter. Apparently their expectations as to labor and fuel supplies have so improved that they count upon larger output of steel than when the original plans were laid. The buying sent the market up $1 to $2 a ton, heavy melting steel being now quotable at $26 to $27, delivered Pittsburgh and valley districts.

Holding Down Prices

As recounted in last report, on December 30, Chairman Gary of the Steel Corporation made a public statement, in which he reiterated the Steel Corporation's policy of holding down its steel prices to the March 21 or Industrial Board schedule, thus removing any doubt as to whether the Steel Corporation would abandon the policy at the end of 1919, for which year the price stabilization program had originally been arranged.

Since then definite proof has been furnished of the Steel Corporation practising what it preaches, in that the unfilled tonnage statement made public last Saturday shows 1,137,036 increase during December. This represented approximately 87 per cent. of capacity for the month, while shipments may be estimated at 73 per cent. of capacity, so that the bookings were 159 per cent. of capacity. None of the corporation's bookings were at above the March 21 prices, unless in the case of export business, and export business does not as a rule figure largely in the unfilled tonnage statement. The statement shows that in December the corporation subsidiaries sold more than 2,000,000 tons of their steel products. This is in striking contrast with the action of some independent producers who nominally adhere to the March 21 prices, in that they have not announced definite advances, but do not sell at all. Many producers have been selling at advanced prices, which have been obtainable for early deliveries, but the total of sales at advanced prices, in point of tonnage, is very small by comparison with the Steel Corporation's sales of more than 2,000,000 tons in a single month at the stabilized prices.

With this situation obtaining, consumers of steel who are greatly in need of material will pay extra or premium prices only for a short period ahead, as they would be placed at a disadvantage by comparison with their competitors who secure their supplies from the Steel Corporation.

Steel Production

Taking the steel industry as a whole, the rate of production is now about 80 per cent. of capacity and the rate is increasing steadily. There remains some labor shortage, but the situation is improving, while the men at work are becoming more accustomed to their jobs. As the strike waned there was much shifting of employment, and some new men were taken in, so that many men have had to be trained. Coke is still scarce, but production is increasing at both by-product and beehive ovens. Coke is almost invariably scarce around holiday time, and usually becomes relatively plentiful after the middle of January. An illustration of this was furnished in the winter of 1912-3, the average price of spot furnace coke in December, 1912, being $4, while January showed an average of $3.85 and February an average of $2.60, representing a drop of 35 per cent., the open market conditions enabling the price to reflect the improvement in supplies.

Prospects now are that by March 1 the steel industry will be operating at 90 per cent. of capacity or better, whereby there will be much more steel available than during the past four months.

A remarkable thing about this steel market situation, when steel is so extremely scarce, is that the steel mills do not have full order books by any means. On an average they are not sold nearly as far ahead as they usually are when industries generally are so active. The Steel Corporation is, of course, sold farthest ahead. Its unfilled tonnage, Dec. 31, as just reported, was 8,265,366 tons, equal to its output in about 6½ months, running at capacity, but some of the tonnage is for far-off deliveries, against construction jobs, and in some products the corporation still has a little unsold output in the second quarter. Then there are some large independents that have been selling scarcely at all of late, most of their present obligations being tonnage deferred from 1919 by the strike. One large interest would be practically out of orders by April 1 if it did not sell between now and that date. Its sales will be made in due course, chiefly or wholly to regular customers, to whom in many cases it has already made definite promises. Then there are the mills that have been charging premium prices, and, of course, they could not sell very far ahead at such prices, even if they wanted to. If the railroads come into the market there will be a moderate amount of rolling space for them.

The Week's Events in Montreal Industry

Lorne C. Webster, of Montreal, has been appointed a Senator, to succeed the late Senator Landry, of the Stadacona district. Senator Webster has had little experience as an active politician, as he has devoted most of his time to commercial undertakings.

William Ross, general superintendent of the Phoenix Bridge and Iron Works, Montreal, died suddenly on the street last Saturday, following an acute attack of heart trouble. Mr. Ross was returning from work when stricken. He was nearly seventy years of age, and had held the position of general superintendent of the Phoenix Works for the past twenty-three years.

After several weeks of suppressed anxiety as to the fate of the "Canadian Spinner," the tension has been much relieved by the latest report to the effect that the vessel, with the ice-breaker Montcalm as a relief ship, will succeed in clearing the ice this week and reaching the port of Sydney. It is not thought that any serious damage has been done to the vessel.

Intensified operations in the Cape Breton coal regions of the Dominion Steel Corporation has resulted in the mining of increased quantities of coal. Official statements gives the production for the month of December as 312,891 tons, an increase of over 40,000 tons over the corresponding month a year ago. Officials of the company state that every facility is being provided to bring the mines up to maximum capacity.

The power plant and the machine shop of the Record Foundry and Machine Company at Moncton, N.B., was destroyed by fire last week. The stove plant was not damaged, but about 100 men will be out of work until a new engine can be installed. The fire originated from an explosion of an oil tank, in which springs were being hardened. The loss will be over $60,000.

In connection with the American Association of Port Authorities, it is interesting to note that a change has been made in the way of news distribution in the monthly bulletin that has recently been issued from the office of the secretary, M. P. Fennell. Formerly, the issuing of the bulletin was an annual affair, so that the new departure will provide current news to the members within a more reasonable period.

City and Board of Trade officials of St. John, N.B., have decided to memorialize the Federal Government to commence early operations in the development of improvements and extensions to the port, to take care of the rapidly increasing trade to this country. In addition to breakwater extensions and increased accommodation as to ship berths and grain elevators, the installation of a wireless station came into discussion and this will probably be included in the program submitted.

That the Canadian Government Merchant Marine is losing no opportunity to develop new trade routes is shown in the arrangement that has just been concluded to establish a direct service between Canada and Brazil.

At the annual meeting of the Dominion Marine Association held last week at the Windsor Hotel, Montreal, the Hon. C. C. Ballantyne briefly reviewed the activities and achievements of the C.G.M.M. After dwelling on the accomplishments of Canadian yards in the construction of freight vessels, the Minister stated that the department had under consideration the building of several passenger ships for operation by the Government service. If the proposal is adopted, these vessels will be built in Canadian yards and with Canadian material, as far as possible. In addition, it was intimated that this departure might be followed by the construction of naval vessels if a naval policy is decided on.

The Marconi Wireless Company of Canada, Limited, has recently formed a subsidiary company known as Scientific Experimenter, Limited, for the manufacture of a product closely associated to their present activities. This work will be in the character of what might be classed as amateur and experimental telegraph and telephone apparatus, and other lines of practical toys distinctly different from the commercial appliances now being made by the parent company. The Marconi factory will be utilized for the manufacture of the new product, and branches will be established in the leading Canadian cities for the sale and distribution of the amateur apparatus.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$33 00
Lake Superior, charcoal, Chicago	38 40
Standard low phos., Philadelphia	40 00-40 00
Bessemer, Pittsburgh	35 00
Basic, Valley furnace	30 00

Toronto price:—
Silicon..2.25% to 2.75% $37.00 to $40.00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 4 75
Steel bars, base, Toronto	4 75
Steel bars, 2 in. to 4 in. base	6 00
Steel bars, 4 in. and larger base	6 50
Iron bars, base, Montreal	4 25
Steel bars, base, Montreal	4 25
Reinforcing bars, base	4 75
Steel hoops	6 00
Norway iron	11 00
Tire steel	5 50
Spring steel	8 00
Band steel, No. 10 gauge and 3-16 in. base	5 25
Chequered floor plate, 3-16 in.	7 50
Chequered floor plate, ¼ in.	7 00
Staybolt iron	8 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	2 35
Tank plates, Pittsburgh	2 65
Structural shapes, Pittsburgh	2 45
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 90
Small shapes under 3"	3 62

FREIGHT RATES

Per 100 Pounds. Pittsburgh to Following Points	C.L.	L.C.L.
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

		Gross.
Lake copper	$25 00	$24 00
Electro copper	24 00	24 00
Castings, copper	24 00	24 00
Tin	65 00	60 00
Spelter	11 50	10 75
Lead	9 50	8 75
Antimony	11 50	10 50
Aluminum	33 00	35 00

Prices per 100 lbs.

PLATES

	Montreal	Toronto
Plates, ¼ up	$ 5 00	$ 5 00
Plates, 3-16 in.	5 25	5 25

Price List No. 38

WROUGHT PIPES

Standard Buttweld		
⅛ in.	$ 6 00	$ 8 00
¼ in.	4 68	6 81
⅜ in.	4 68	6 81
½ in.	6 21	7 78
¾ in.	7 82	9 95
1 in.	11 56	14 71
1¼ in.	15 64	19 90
1½ in.	18 70	23 76
2 in.	25 16	32 01
2½ in.	40 37	51 19
3 in.	52 79	66 94
3½ in.	67 16	84 18
4 in.	79 57	99 74
Standard Lapweld		
2 in.	38 81	35 34
2½ in.	42 12	52 36
3 in.	55 08	68 47
3½ in.	69 00	86 94
4 in.	81 75	103 00
4½ in.	93	1 18
5 in.	1 08	1 37
6 in.	1 40	1 78
7 in.	1 83	2 32
8L in.	1 93	2 44
8 in.	2 22	2 81
9 in.	2 66	3 36
10L in.	2 46	3 12
10 in.	3 17	4 02

Terms 2% 30 days, approved credit.

Freight equalized on Chatham, Guelph, Hamilton, London, Montreal, Toronto, Welland.

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.
4½" and larger 50%.
4" and under, running thread, 30%.
Standard couplings, 4" and under, 40%,
4½" and larger, 20%.

OLD MATERIAL

Dealers' Average Buying Prices.

Per 100 Pounds.	Montreal	Toronto
Copper, light	$14 00	13 75
Copper, crucible	17 00	17 00
Copper, heavy	17 00	17 00
Copper wire	17 00	17 00
No. 1 machine composition	15 25	16 00
New brass cuttings	11 00	10 75
Red brass cuttings	14 00	14 75
Yellow brass turnings	8 00	9 00
Light brass	6 25	7 00
Medium brass	7 25	7 75
Scrap zinc	6 00	6 00
Heavy lead	5 00	6 00
Tea lead	3 75	3 50
Aluminum	18 00	18 00
	Per Ton	Gross
Heavy melting steel	15 00	16 00
Boiler plate	15 00	11 00
Axles (wrought iron)	25 00	20 00
Rails (scrap)	16 00	16 00
Malleable scrap	25 00	20 00
No. 1 machine cast iron	24 00	25 00
Pipe, wrought	10 00	9 00
Car wheels	22 00	20 00
Steel Axles	21 00	20 00
Mach. shop turnings	9 00	11 00
Stove plate	22 00	21 00
Cast boring	10 00	11 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜" and less	15
Carriage bolts, 7-16 and up	Net
Coach and lag screws	30
Stove bolts	50
Wrought washers	50
Elevator bolts	5
Machine bolts, 7-16 and over	10
Machine bolts, ⅜" and less	20
Blank bolts	25
Bolt ends	10
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square blank	add $1.50
Nuts, square, tapped	add 1 75
Nuts, hex., blank	add 1 75
Nuts, hex., tapped	add 2 00
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent.
Set screws	40
Sq. and Hex. Head Cap Screws	35
Rd. and Fil. Head Cap Screws	5
Flat But. Hd. Cap Screws	10
Fin. and Semi-fin. nuts up to 1 in.	35
Fin. and Semi-fin. nuts, over 1 in., up to 1½ in.	25
Fin. and Semi-fin. nuts over 1½ in., up to 2 in.	10
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws......list plus 20,	30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$43 00
Open-hearth billets	43 00
O.H. sheet bars	46 00
Forging billets	56 00
Wire rods	55 00

Government prices.
F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$4 95
Cut nails	5 00
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 32
British Manila rope	0 26
New Zealand hemp	0 26
Transmission rope, Manila	0 43
Cotton rope, ¼-in. and up	0 80

POLISHED DRILL ROD

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CANADIAN MACHINERY AND MANUFACTURING NEWS

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Further Examples of Jig and Fixture Work

The Concluding Portion of Article Describing Various Type Fixtures Used in Milling Machine Construction. We Find Herein That a Very Simple Fixture is Often the Solution to Our Interchangeable Problem

By J. H. MOORE, Associate Editor, Canadian Machinery

IN the first portion of this article we described and illustrated six simple jigs used in the manufacture of certain portions of a well-known milling machine. In this, the second and last portion of the article, we will consider other six fixtures used in the making of these machines.

The first to be considered is the worm box jig shown at Fig. 1. This is a fixture of the box type, as can be readily noticed. The worm box is also clearly seen resting on the top of jig. To load the work in the fixture, the plates A and B are first removed. The gear box is placed in jig bottom down until it hits the screw C. The plates are now placed in position. The work is next adjusted by set screws until it comes up to positive stop. The screw C is next tightened, which holds the work securely against the plates A and B, after which the work is drilled. Six holes are drilled in this operation, these being clearly noted on the photograph.

FIG. 3—JIG FOR DRILLING THE OVERARM.

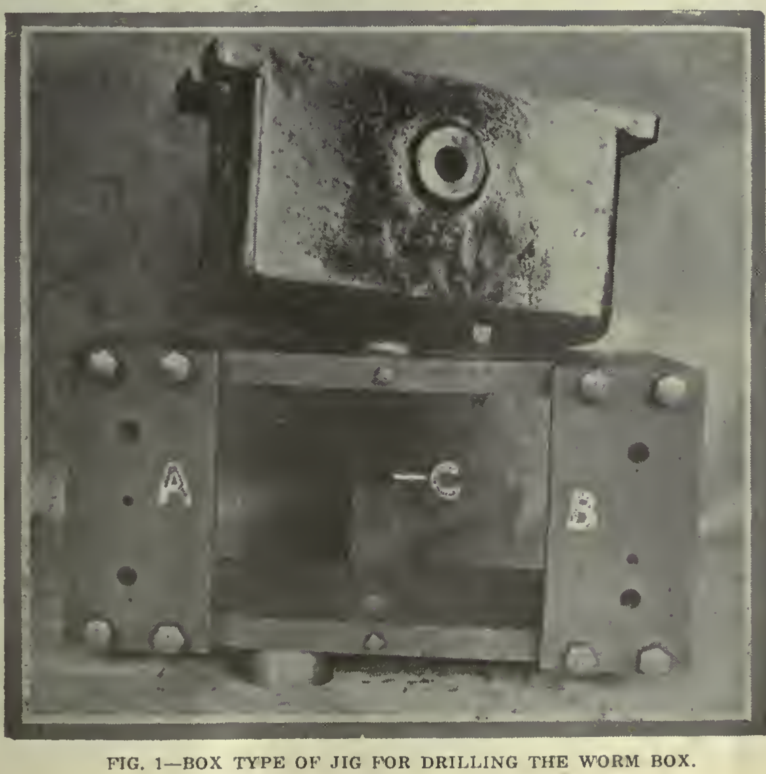


FIG. 1—BOX TYPE OF JIG FOR DRILLING THE WORM BOX.

Gear Lever Jig.

The next fixture is that shown at Fig. 2. The price illustrated at A represents the work which is known as the gear feed box change lever. This is a steel casting, for considerable strains are exerted on this piece while in actual use. Before being ready for this operation, the hole B is finished. The work is now placed in the jig in the following manner: The hole B goes over the stud C, while the portion D rests against the stop E, and is tightened up against the stop by the set screw F. First, a hole is drilled at G, then the jig is turned end for end, and a hole drilled at H. The fixture is now placed on its side, and the two holes drilled through the bushings J and K. In this way four holes are drilled at the one set up. An essential point to watch in a jig of this nature is the importance of having all resting surfaces planed perfectly true and at right angles to each other.

Overarm Jig.

At Fig. 3, we illustrate a jig for drill-

FIG. 2—A SIMPLE BUT EFFICIENT GEAR LEVER JIG.

ing five holes in the overarm steady rest. The idea is very simple. A plug of similar diameter to that of the overarm fits into the finished hole A, while the lug B, with its adjustable stop C, hits up against the boss D. A set screw on the other side tightens up the complete fixture. Five holes are now drilled, four to accommodate the brace, and one to suit the arbor. The remaining details of the fixture are so self-apparent that we leave the reader to study the photograph at his leisure.

Fig. 4 illustrates a double purpose fixture of almost ridiculous simplicity. So simple, in fact, that we hesitated illustrating it, yet it accomplishes its purpose —so why not?

First, it is used for drilling the spring pin hole in the face gear, as shown at A. A plunger of proper diameter fits the bore of the gear and in this way centering the jig, as the distance from the center of this plunger to the center of either bushing is the correct radius necessary.

The bore of the step cone pulley, B, is of similar size to that in the face gear, therefore the same jig is used. In the operation on the pulley the four holes are drilled; drilling two holes at a time. In both these cases, the jig is held securely by means of a long bolt with washer and nut.

Two Other Examples.

The next illustration, Fig. 5, depicts two other drilling jigs.

At A is shown the fixture for drilling the gear guard which goes at the end of miller table. At this operation, it is only desirable to drill the hole B. To accomplish this, a pin of proper diameter is placed into the already finished hole C, which, of course, centres the jig as far as this hole is concerned. The other end is centered by means of adjustable set screws, illustrated on photograph.

The other jig shown at D represents the fixture used to drill the change gear handle bracket. On this operation the piece is placed over the stud E and pulled up to place by means of the nut shown. Adjustment is also obtained from the set screw F. The remainder of the jig is so self-apparent that we make no further comment.

Dividing Head Jig.

A very important portion to any miller is that of the dividing head. For this reason, the drilling of the head must be watched with care. In the illustration shown the head has passed through the operation of drilling the three holes in its side A, B and C. The head is placed in a duplicate base D similar to that used on all dividing heads which passes through the plant. In this way they are assured of accurate results. The base in turn has a groove in it, which slides on the tongue E. This groove is also a duplicate of the size used on the miller table. The complete arrangement is slid into the jig proper, until it hits up against the stop F. The bolt G, and another similar bolt at the other end (but not seen on the photo) is tightened into place, holding everything securely. The jig is now turned up and rests on the faces H and J, which are, of course, machined at right angles to the other face. The one bushing is interchangeable for all the holes drilled.

While none of the fixtures illustrated have been of the complex variety, they have delivered the goods, which is what counts when all is said and done. Of course, in some cases, work, owing to its complex nature, demands a more complicated jig, but where the piece is of a simple type similar to the example shown, there is no necessity of expending more money than is absolutely necessary

FIG. 4—A DOUBLE PURPOSE SIMPLE JIG.

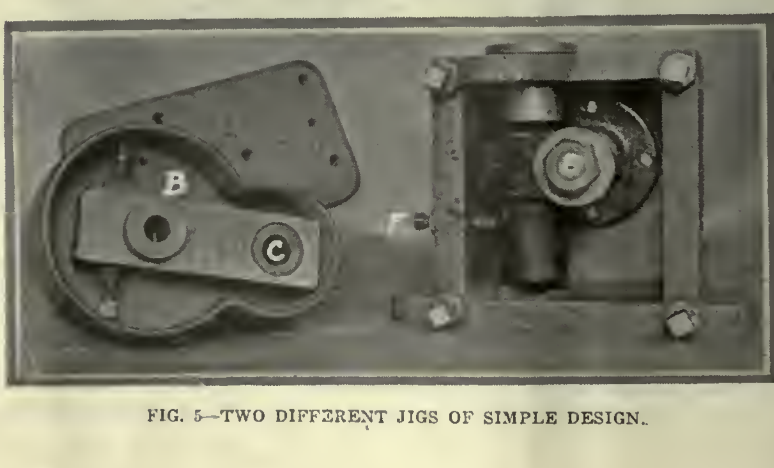


FIG. 5—TWO DIFFERENT JIGS OF SIMPLE DESIGN.

on the fixture. In a later article we shall illustrate some other jigs of a more complex nature.

FIG. 6—THE DRILLING JIG FOR DIVIDING HEAD.

CHANGES AT CHAPMAN CO.

A DEVELOPMENT and change of considerable importance has taken place at the Chapman Double Ball Bearing Co., Ltd., Toronto, Canada. As readers of CANADIAN MACHINERY are no doubt already acquainted with the well-known line of ball bearing equipment turned out by this firm, we will make no comment on their existing lines, but will first discuss the new position attained by Frank H. Lennox, who formerly had charge of the sales department of this concern.

Mr. Lennox has now been appointed assistant manager, with special duties, which will be explained in detail later on in the announcement.

Previous to coming to Toronto as sales manager for the parent company, Mr. Lennox was assistant sales manager at the United States company, whose plant is situated at Buffalo. He first entered their employ as mechanical engineer, afterwards becoming road engineer, and then sales engineer. He also attended Michigan University, studying engineering in its various phases. He spent a few years with some of the largest manufacturers of ball bearings in the United States. His one source of information and conversation, which never fails, is that of ball bearings, with their proper application.

FRANK H. LENNOX.

Service That Will Be Service

Speaking of the proper application and installation of ball bearings brings us to the second position of our story. It is the intention of this company to create a service in attending to customers' requirements that will have no equal.

In speaking of this service, Mr. Lennox mentioned that what they were particularly anxious to accomplish was this: "To let every manufacturer know of the service, and to have them realize that it was open to them without any obligation on their part."

"In what manner do you propose to supply this information?" we asked.

"By answering any enquiry pertaining to ball bearing installation. You know," continued Mr. Lennox, "in all respect to the average draftsman or designer, they know very little about the proper installation of ball bearing equipment. The subject is a very difficult one, combining various formulae with which only ball bearing manufacturers are conversant. For this reason the proper size of bearing is not actually figured out, but guessed at. Such a condition does not produce maximum efficiency, but far from it.

"Then, again, the subject of proper protection against dust is seldom considered as it should be, and as anyone can understand, this is a most important point, for without the proper protection, the bearing cannot deliver the best results.

"We have often found the following condition to exist: A manufacturer decides to install a ball bearing installation in some portion of his product. His designer goes to work, drafts up his idea of what the installation should be, and sends us the result, with a request to state cost of such an installation.

"As a general rule, we are forced to reply that the design, as shown, is not what it should be, submitting to the firm a new layout at a reduced cost to the manufacturer.

"The unfortunate part, however, is this, that the firm concerned may have, in the meantime, proceeded with their pattern changes, thus necessitating a further change to our corrected design. This condition holds good in practically all the proposed layouts sent in for our approval.

"It is such a state of affairs that we hope and intend to overcome. Our trained staff of expert designers allow us to feel assured that such a condition can be stamped out, if, in turn, we receive co-operation from the various manufacturers."

A New Line

In addition to this service, the firm spoken of are now handling two new lines of annular ball bearings. These new types are known respectively as the Schatz Universal, and the Schatz Commercial.

The former bearing has as its feature a three-area contact, which absolutely ensures against any binding strain. This type of bearing is supplied in light, medium and heavy series, and in millimeter sizes.

The second style handled is that of the commercial design. Two types, A and B, are made, the style A not being ground, while the type B is ground in the bore, outside diameter, and ball tracks. These two commercial types are supplied in English sizes only.

Each type has its own particular use, and to those interested we can only add that catalogues can be secured by request, which illustrate these lines fully, going into the mechanical details.

Taken in its entirety, this announcement of new appointment, new lines, and added service is one that should interest every manufacturer contemplating the use of ball bearing equipment.

The Generating Process of Producing Gears*

It is Questionable if the Average Mechanic Understands Thoroughly the Fellows Principle of Gear Cutting. This Article Covers the Subject in an Able Manner, Discussing Different Styles of Work Accomplished

ALL surfaces produced mechanically are either formed or generated. The simplest generating operating operation is that of a planer, which produces a plane or flat surface by means of the point of the planing tool. Another simple generating operation is the production of a cylinder by traversing the

FIG. 1—TWO CUTTERS AS DESCRIBED IN TEXT.

point of a lathe tool in a straight line while the surface being produced is rotated on its axis.

The simplest forming operation is the production of a plane or flat surface by using a broad milling cutter. It is obvious that any errors in either the form or the setting of a formed milling cutter will result in similar errors in the surface produced.

The generating process of producing a true surface of any definite kind offers fewer chances for error than the forming process. In gear cutting both the form-

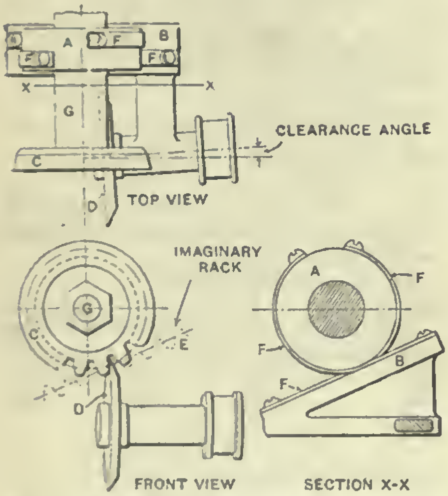


FIG. 2.—SHOWING THE PRINCIPLE OF THE CUTTER GRINDERS.

ing and generating processes are used.

Since the cutters used in cutting gears can only reproduce in the finished work their own accuracy, it may be of interest to note how the cutters for each process are made.

The shape of the formed milling cutter is dependent upon the methods employed in making the template. These are generally hand and eye methods, requiring superlative skill even to approach accuracy. Then again errors due to hardening cannot be avoided, no matter how carefully that operation is performed. In the end the formed milling cutter when ready for use must naturally be inaccurate.

On the other hand the cutter as used on the Fellows gear shaper is itself a generated gear. It is first roughed out and then hardened. In Fig. 1 the left hand cutter has been hardened, but the tooth outlines are only roughed out while the right hand cutter has been finished. The involute tooth outlines are generated on the cutter by grinding after hardening. Thus any errors can be rectified, producing a very accurate cutter.

FIGS. 3 AND 4.—SHOWING EITHER GRINDING IN ROLLING CONTACT WITH WHEEL.

In grinding the tooth outlines advantage is taken of the fact that the flanks of an involute rack tooth are straight. As every gear will mesh correctly with a rack of the same pitch, it follows that every gear that meshes with its rack correctly will run correctly with each other. It is therefore possible to replace one of the flat faces of the imaginary rack with the flat face of the grinding wheel (D). This, in conjunction with the rolling motion of the blank, will cause the wheel to grind a true involute curve on the face of the teeth.

The principle of the cutter grinder is shown in Fig. 2. The grinder (A) is of the same diameter as the pitch of the cutter, and rolls on the plane surface (B). It is constrained to roll on that surface without slipping by the action of tapes (F), which control this rolling motion. The cutter (C) is mounted on the end of the spindle (G), which is solid with cylinder (A). As the cylinder is rolled up and down the plane the cutter, by means of the tapes on the cylinder, is caused to roll in exactly the same way as

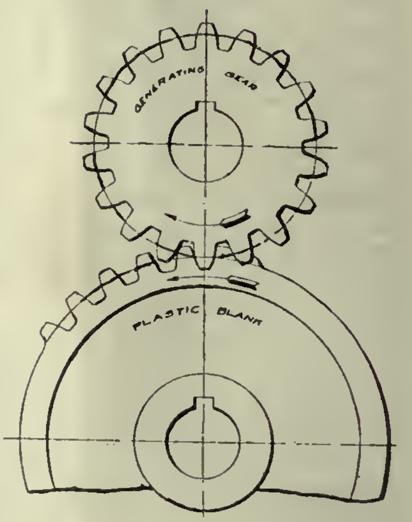


FIG. 5.

a gear in mesh with an imaginary rack (E) shown by dotted line.

Fig. 3 shows the cutter just rolling into contact with the wheel. At Fig. 4 it is nearly at the end of its rolling motion ready to return. By means of special instruments the gear shaper cutter is measured for tooth thickness and tooth space at the pitch line of every tooth and space on every cutter made. The measurements are indicated by a 10 to 1 multiplying lever bearing on the contact point of a dial micrometer gauge, which gives readings directly to .0001 of an inch; the error from one tooth to another must be well within .0004 before it is passed.

The principle of operation of the Fellows gear shaper is similar to the action of two gears in mesh; one gear, the cutter, is provided with teeth, which are relieved to facilitate cutting and to provide for sharpening without change of

FIG. 6.

*From "Machine Tool Review."

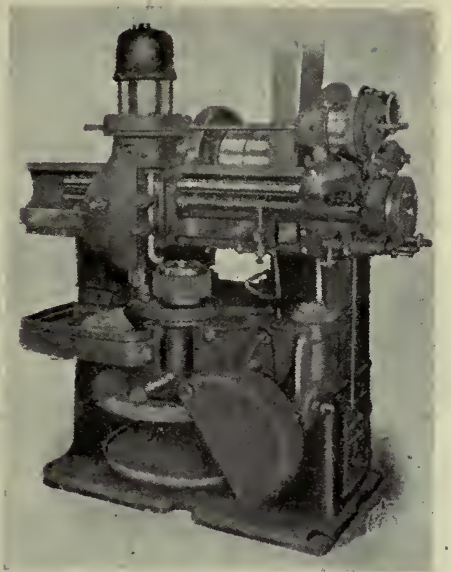


FIG. 7.

form, and the other is the gear blank to be cut.

Fig. 5 shows a metal gear rolling with a blank made of some plastic material, such as wax. When rolled together, as if they were a pair of gears in mesh, the generating gear will mould teeth on the plastic blank of proper shape to engage it. If the teeth of the metal gear are properly designed they will generate correct tooth outlines for a 12-tooth blank, for rack or for any number of teeth upwards, all of which will run properly with the generating gear or with each other.

Fig. 6 shows the scheme applied to the cutting of metal gears. The generating gear is made of hardened steel sharpened to a cutting edge all round its profile. The cutter is held on the cutter spindle mounted in the ram, and is given a reciprocating motion similar to that of a crank shaper.

At the same time the work and cutter are connected by gearing so that they slowly rotate together. The work blanks are mounted on an arbor held in the table or apron of the machine which is fitted with a relieving arrangement for withdrawing the work from the cutter at the return stroke of the latter.

Fig. 7 shows an illustration of the No. 6 Fellows gear shaper. The apron on which the work is mounted can be swung clear of the machine in order to facilitate

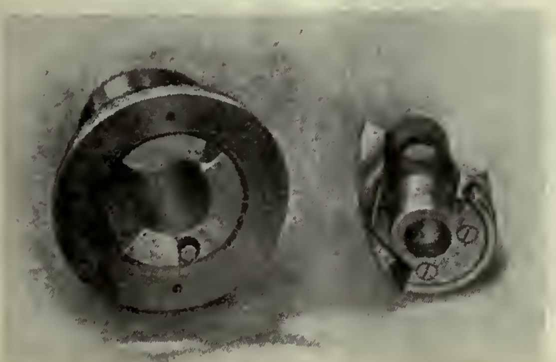


FIG. 10.

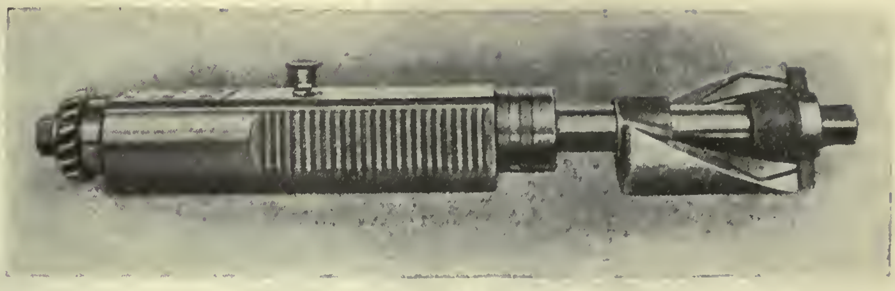


FIG. 9.

setting up. Two independent motions are provided for the feed of the cutter, the depth feed by which the saddle carrying the cutter is fed into the blank, and the rotary feed by which the cutter and blank are slowly rotated in unison. The rotary feed of the cutter is effected through change gears to preserve the correct relation between the number of teeth in the cutter and the number of teeth in the gear to be cut. A special chart gives the correct change of wheels to use.

In commencing to cut a gear it is usual to engage the depth feed first, the cutter being allowed to feed in three-quarters of the depth before the rotary feed is engaged. When specially accurate gears are being produced in large quantities it is more economical to use one or more gear shapers for roughing and another battery for finishing. In this way the cutter is not called upon to take roughing and finishing cuts, and so the finishing cutter which takes only a light cut will last much longer and produce better work.

Helical Gears

Spur gears with helical teeth are gradually superseding straight tooth gears where quietness of action is important. The reason for this is that in helical gears the tooth contact is progressive. It is made first at one end of a pair of teeth, then a little further from the end, and so on progressively until the end of the tooth is reached. By this time another pair of teeth will be in contact at the front end.

The Fellows Company have designed a machine for cutting the teeth of helical

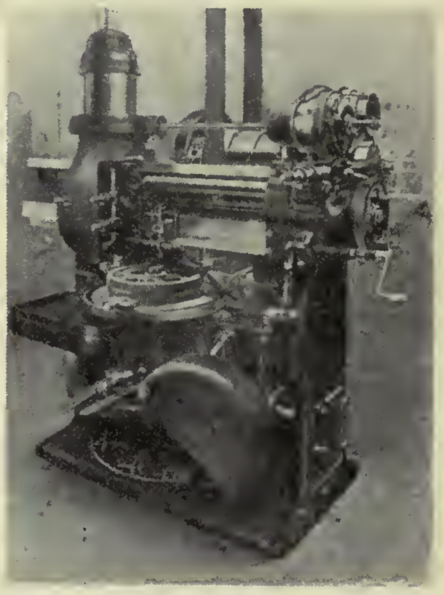


FIG. 12.

spur gears, both internal and external. It is similar in principle to the straight spur machine, with the exception that the cutter and cutter slide are given a spiral motion to correspond to the helix angle of the cutter. The substitution of

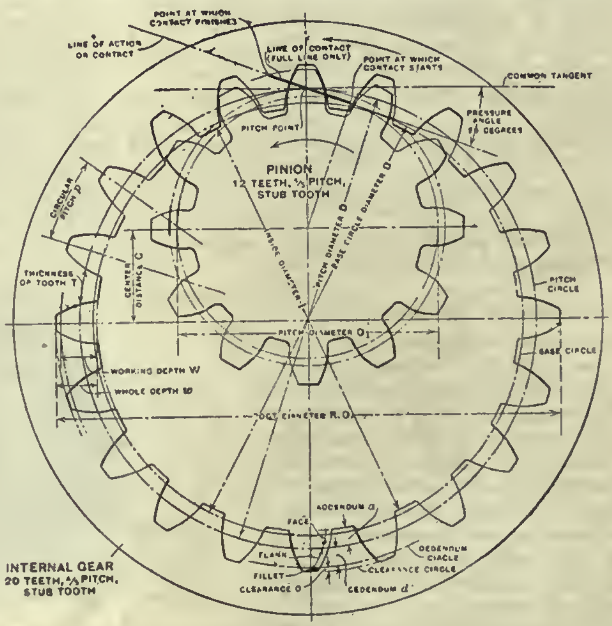


FIG. 13.

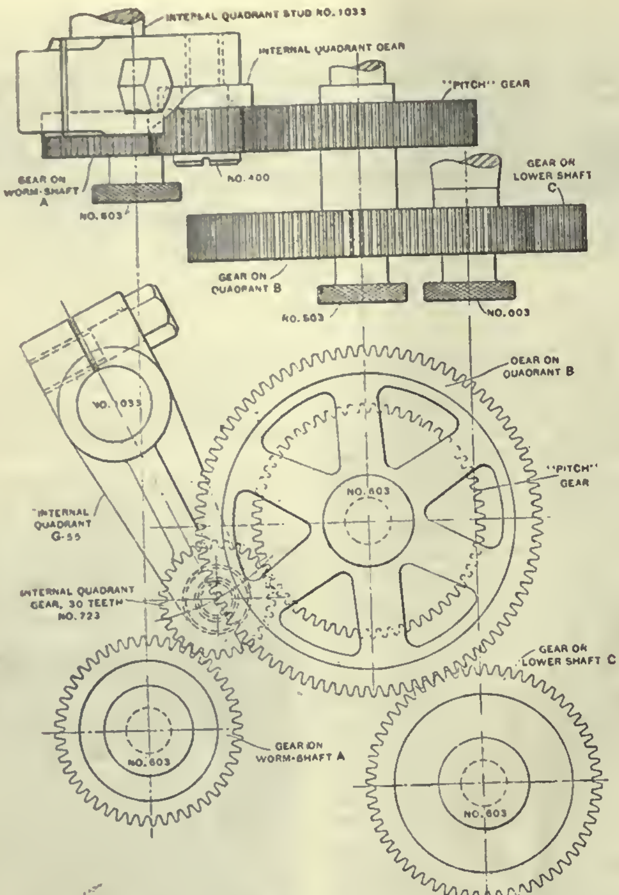


FIG. 14.

a helical in place of the straight guide to the cutter spindle, as shown in Fig. 9, produces this motion.

The guide shown in Fig. 10 is a block of cast iron, and is generated by means of special machinery to exactly the same angle as the lead angle of the gears to be cut. The mating guide, also shown in Fig. 10, is fixed in a large hub, which forms part of the upper index wheel. The guide in the hub is split and provided with endwise adjustment to take up any wear.

By means of the special machinery used any number of guides can be generated, enabling gears of exact interchangeability to be produced in large quantities.

The guides are quickly changed; ten to fifteen minutes only being necessary to change from one helix angle to another or from left to right hand gears.

Fig. 12 shows a helical machine cutting the driving gear of a British electric truck.

Internal Gears.

The cutting of an internal gear prior to the advent of the Fellows machine, presented a difficult proposition and was, as a rule, accomplished by make-shift means. The cutting of an internal gear on the Fellows gear shaper does not differ materially from that of cutting an external gear, the only difference being that an intermediate gear must be inserted in the train of change gears so as to keep the cutter and work rotating as two gears in mesh.

It will be realized that when cutting external gears the work and cutter rotate in opposite direction to each other, whereas on internal gears the work and cutter must rotate in the same direction. Fig. 13 illustrates this. An intermediate gear is therefore put between the gear on the worm shaft and the pitch gear (see Fig. 14). Otherwise the selecting and setting of the change gears is accomplished in the same manner as for external gears.

In cutting internal gears it is necessary to provide a groove at least 3-32 in. wide for the cutter to run into at the end of its stroke. This is to provide for the excess stroke of the cutter and for chip room.

Compactness of design and efficient tooth action represent two of the most important advantages that the internal gear possesses over the external gear. These two advantages make the internal gear particularly applicable to speed-reducing mechanisms. Within the past few years the internal gear drive has been applied with success to trucks and other heavy commercial vehicles, tractors, etc. This form of drive is highly efficient, and forms a very convenient and satisfactory means of transmitting power. Fig. 15 shows a phantom view of a popular type of internal gear drive axle as applied to trucks.

Internal gears give a highly efficient result when applied to reduction mechanism. An example of this type of gear is shown in Fig. 16, which illustrates what is known as the Turbo reduction gear. These reduction gears are made in various capacities, and are capable of transmitting power under different conditions. The particular ratio shown is for a 500 h.p. Turbo gear turbine drive, having a reduction of 7 to 1. The internal gear, as shown in Fig. 17, is applied to a disc clutch. The external member of this clutch is an internal gear, and sliding in this is a series of discs. These discs are kept in contact by means of a stiff spring, and as their faces are provided with a form of brake lining a very satisfactory drive is secured. As soon as the tension of the spring is overcome the discs are separated and the clutch disengages. When used in this connection the internal gear is simply used as a multiple spline. This is clearly illustrated in Fig. 18 where a detail view is shown of the internal gear member of a disc clutch.

Irregular Shapes.

At first sight the production of irregular shapes, such as gas engine and

FIG. 15.

other cams, would appear to be beyond the scope of the Fellows gear shaper.

As a matter of fact, however, the machine will produce a more accurate cam than can be obtained by any other known method. The cutters have to be specially made to the required shape depending upon the cam.

The foregoing description of the gear shaper and the character of the work it is adapted to handle will illustrate the almost universal application of this machine. New uses are being found for the gear shaper every day, and for the information of the designer and manufacturer a list of some of the work the gear shaper is now handling on a commercial basis is appended.

Spur Gears, external and internal, within the capacity of the machine. External, pitch dia. 35 in., face width 51 in., pitch 4 D.P. Internal, pitch dia. 26 in., face width 3 in., pitch 4 D.P. Spur, cluster and shoulder gears.

Helical Gears, external and internal within the capacity of the machine. External, pitch dia. 26 in., face width 5 in., pitch 5/7 stub. Internal, pitch dia. 26 in., face width 3 in., pitch 5/7 stub. Helical, cluster, shoulder and double helical gears.

Herring-bone Gears. Chain sprockets. Ratchets, internal and external. Cams of all shapes both internal and external within the capacity of the machine. Geneva stop cams. Splined shafts and keys not exceeding 5 in. long. Graduating, and dividing.

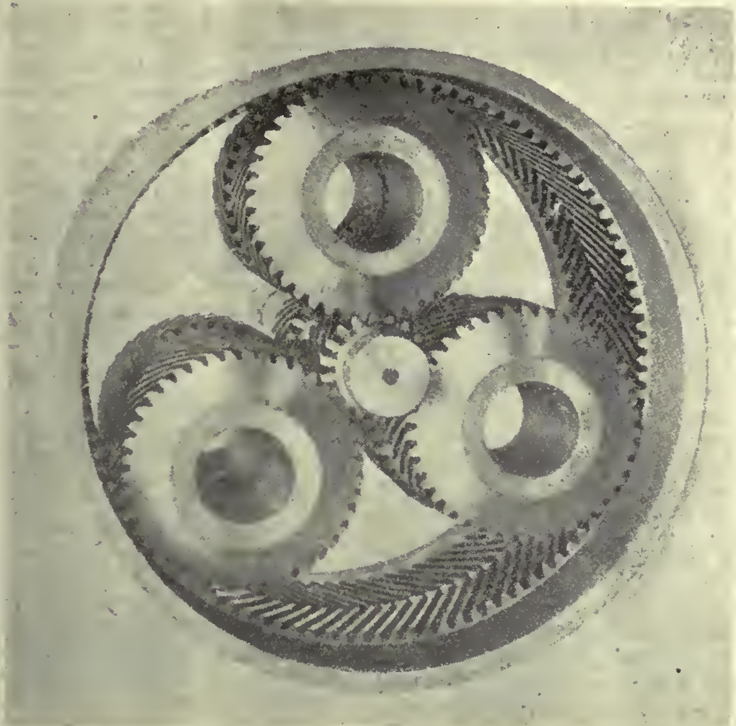


FIG. 16.

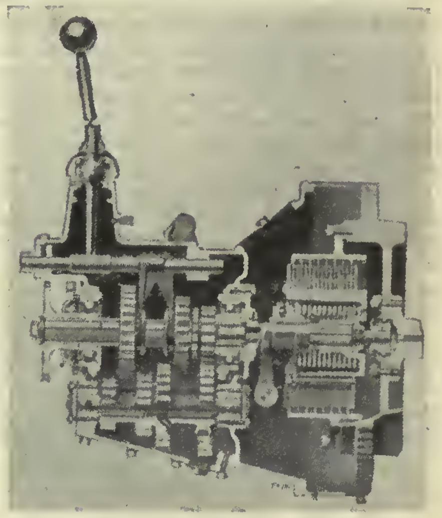


FIG. 17.

PYROPHORIC IGNITION

One of the minor changes brought about by the war is the increased use made of pyrophoric ignition devices, which are, after all, merely a modern form of the old flint and steel and tinder box. Where flint was used the sparks obtained were weak and uncertain and a good deal of practice was required before the tinder could be ignited with certainty. It was not long before it was found that various forms of pyrites, struck by steel, gave off sparks of greater heat and larger size, and had it not been for the discovery of the mineral cerite, there is no doubt that the use of pyrites would have been still further developed.

The spark-giving properties of cerite, when first discovered, seemed likely to prove of little commercial value, as there was a difficulty in producing the substance in sufficient quantities. A German scientist, Muthmann, gave a good deal of attention to the subject and devised, with the aid of his students, a method by which cerite could be produced by the aid of fusion and electrolysis. Another German, Auer, whose name is chiefly known in connection with the gas mantle, availed himself of the discoveries of his predecessor, but even he did not realize the commercial importance of the discovery. He took out a patent covering the use of alloys of cerite with heavier metals, and this had the effect of checking the investigation of others in the mineral and its properties. An Austrian, in Vienna, disregarded the Auer patent, and having become possessed in some way of a specimen of the Auer alloy, devised a pocket kindling apparatus, in cartridge form, in which a piece of steel, suitably notched, was made to rub against a piece of cerite alloy, by pressure, and give off sparks which were caught on a piece of charred rag which could be used for lighting pipes or cigarettes. Hearing of this, Auer took steps to safeguard and develop his discovery and ultimately sold his German patent to a Cologne company, who paid a sum equivalent to £30,000. The Austrian inventor also began the development of his cartridge lighter in a commercial form, and there was subsequently a keen competition between the German and Austrian houses, and the ultimate outcome was an attack on the validity of the Auer patents. At that date it was known that Auer had made several errors in connection with his gas mantle patents, and whether this influenced the decision or not, the Patent Office annulled the second Auer patent. Auer had stated that the pure metal, cerite, did not possess pyrophoric properties and although he subsequently altered his opinion on the matter, it was decided that his patent only related to alloys which contained 30 per cent. and over of heavy metals. According to Dr. Bohm, another German scientist, the use of light metals as alloys suitable for use with cerite was not mentioned in the Auer patents, although a manufacturing firm, Kunheim & Co., had specified these. As a result of several objections their patent was also annulled, and as a result there is to-day no monopoly in pyrophoric materials. According to him there is a third possibility of producing pyrophoric substances, illustrated in the so-called Lucium patent. The efforts of Krieger to produce pyrophoric alloys containing no cerite have so far only led to the discovery and use of materials which only give out satisfactory sparks under certain restricted conditions.

ERRATUM

A regrettable typographical error occurred in the Dec. 4th issue of CANADIAN MACHINERY in connection with the leading article on the Greaves-Etchells electric furnace. On page 547, third column, the statement is made that "During this time 220 heats were run off. This statement is erroneous, and should read: "During this time 2,200 heats were run off."

The Use of Vee Blocks in the Machine Shop*

While Vee Blocks Are Used in Many Ways in the Machine Tool Industry, it is an Open Question if Their Value as an Accurate Means of Lining Up Work is Appreciated and Understood

By JOSEPH HORNER

GENERALLY all cylindrical articles that are not held in special fixtures are attached to machine tables while supported in vee-blocks. They are seldom put in semicircular seatings, because these will only take one exact diameter, while a vee will accommodate diameters that vary by from half-inch to an inch, dependent on the depth of the vees. These sustain the cylindrical articles centrally, they prevent them from rolling about, and they also maintain them at a uniform height from the table. The vees provide the support; the clamping is done in various ways, differing with circumstances. The cylindrical pieces held are mostly shafts and spindles that have key-grooves cut in them or facets tooled. But a considerable volume of work of a different character is held for tooling of other kinds, for which the shaft located in the vees is not the part operated on, but an intermediary, to carry the work to be planed, milled, etc. Brackets and articles of many kinds

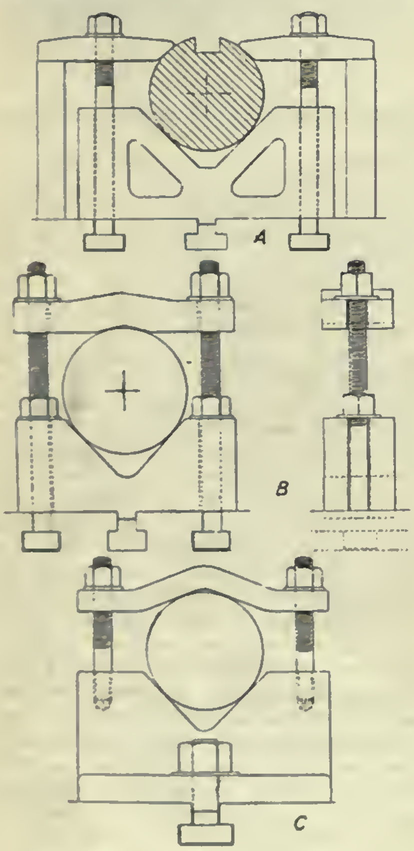


FIG. 1.

that have bored bosses have shafts thrust through their bored holes, and the shafts are laid in the vees and, being clamped down and the bracket also being suitably secured, its foot or the other portion to be faced is dealt with. The advantage gained is that the machined face occupies its correct relation to the bored hole, and it is more likely to be accurate than if it were faced first and the hole bored subsequently.

These very essential blocks occur in a good many varieties. The plainest kinds are represented by the typical form in Fig. 1, A. The block is made in forged iron or steel in the smallest sizes, in cast iron in the larger, and lightened out as shown in the largest. It is simply laid upon the table, in many cases without any tongue to guide it in the tee-groove. The work is very commonly clamped in the manner shown, but only necessarily so when a key groove or a facet has to be tooled along the whole length of the shaft, to permit of which the clamping plates must be kept clear of the tool. The abutting ends of the clamps are made convex, and if the shaft is polished it is well to insert a bit of packing, of card or soft metal sheet, to prevent it from becoming marked by the clamps. These clamps and their packings are those used for general service on machine tables. The bolts that secure the clamps also hold the vee-blocks down.

When the tooling to be done is not continuous, but only occurs along a portion of the lengths as, say, near the ends, the clamp plates may be bridged right across. (Fig. 1, B.) In this instance the clamps are portions of the vee-block, which economizes time spent in fixing up. There is the further greater advantage that the bolts can be brought very close to the work, instead of standing a considerable distance away from it, as at A. The grip will be better. The bolts are a permanent fitting in the vee-block. The lower nut holds the block down on the table, the upper nut tightens the clamp plate on the work. The bolts are slid into place endwise in the block through open slot holes with clearance. The alignment of the blocks is secured by a shallow tongue on the base that fits the tee-grove. A slight self-centring of the clamp plate is provided for by cutting a shallow vee of large angle to fit on the work.

Fig. 1, C, shows another design, in which the block has a tongue fitting in the tee-slot. The bolts are permanent fittings, being stud bolts in this instance. A separate clamping bolt is therefore necessary to hold the block down It goes through the flange seen. The clamp plate is a slightly better form than that shown at B, because, being cranked downwards, it affords a larger area to grip the work, and the bolt length is correspondingly lessened, giving a steadier grip.

There are several designs of vee-blocks which are used to accommodate different diameters on a single piece of work. This is very often done by selecting a couple of blocks that stand at different heights. But the difficulty often then is to get the precise differences in heights required, which renders the use of thin packings necessary. There are of angular section laid in the vees, or they are plain packings under the foot. These adjustments are avoided by employing

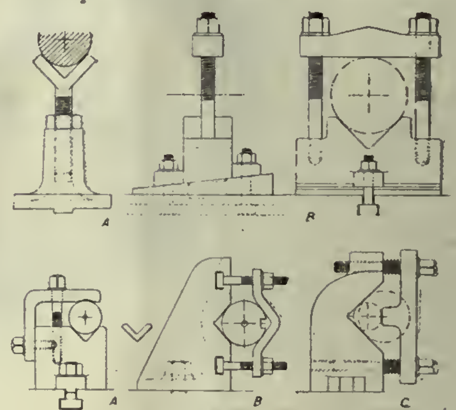


FIG. 2.

vee-blocks of either of the shapes shown in Fig. 2.

At A the vee has a screwed stem entering a boss with a tongued base. The screw has a locking nut. The height adjustment required is obtained by rotating the vee, setting its height by measurement and locking its screw with the nut, after which the work is laid in and clamped by the method most suitable for the job. In the example shown, as in all tall blocks, the height is unfavorable to stability, but this is unavoidable in many cases. A common illustration of this kind is that of a dip crank, where the shaft must be raised high enough to permit the crank to clear the machine table. At B another design is shown, which is rather better than at A. Here the vee-block is made separately from its base, fitting to it with an inclined plane, which affords a fair range of height adjustment. In this feature it resembles a good many adjustable packing blocks. The stud bolts in B fit into the vee-block and the clamp plate is a permanent fitting. It is stiffer than those previously shown, being thickened where the bending stresses consequent on the tightening of the bolts come.

The group in Fig. 3 shows blocks suitable for holding articles that have to be milled with a horizontal cutter. In A the block is bolted to the table through a tee groove, to which it fits by a

*From "Hardware Trade Journal."

tongue. The clamp plate, of right-angular shape, is attached permanently to the block. It is adjustable in the vertical direction to accommodate varying diameters through a slotted hole moving over the set-screw that is tapped into the

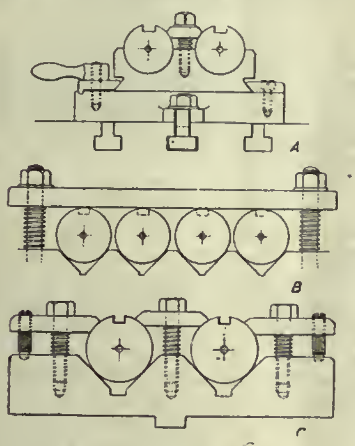


FIG. 3.

block. A set-screw above grips the piece of work through the clamp, which is veed to embrace it. Packings can be inserted, one of which is seen to the right.

The objection to this form is that, although it admits a fair range in diameters, each different diameter stands at a height which varies with diameter. If the centre for one coincides with the horizontal axis of a cutter the centres for all other sizes will not, but will stand higher, or lower, with increase or lessening of size. This in the case of a machine where the cutter cannot be adjusted for height renders the form objectionable. A better design therefore is that at B, where the vee is cut in a vertical face, so that all diameters will lie in the same horizontal axis. The clamp plates, if fitting permanently as shown, would interfere with the cutting of a groove along the entire length, but not with tooling in lesser lengths. If a whole-length cut must be taken plates and packings like those in Fig. 1, A, can be substitnted.

A variation in this form is shown by Fig. 3, C. The principal difference lies in the larger range of capacity provided in C. The vee is very deep, so that it will centre a small shaft like that shown, or one much larger, indicated by the dotted circle. The clamp plate is designed to accommodate this range, having a projection on one side for small shafts and being left flat on the other for large sizes. Another detail of value is the fitting of coiled springs to throw the clamp off the work on the release of the nuts.

In all the previous examples only a single article is gripped at one time, which is not economical when quantities are called for. For these requirements special blocks are made, which may be grouped with the fixtures. In Fig. 4, at A, a block is shown which carries two shafts lying in semi-circular recesses with means for rapid gripping. The block is made in two portions with a base bolted to the machine table, through a bolt in a lug at each end with open slot holes and the work-holding block, which lies on this and is held between bevelled edges, one of which is screwed fast by the strip to the right, while the other, to the left, is tightened with a lever nut. This strip has an abundant tongue fitting in a groove. Its face stands off the base, so that the tightening of the nut causes the bevelled edge to take a grip on the block. The latter will only receive shafts of one exact size, so that it is only suitable for repetitive work. Two shafts are shown, held with central clamp plates with set screws and spring to throw them off when the nuts are loosened.

The vee-block shown in Fig. 4, B, has provision for holding four shafts to be tooled only over portions of their length, since one clamp plate covers the whole series. Springs throw the plate off. The block at C has separate clamp plates, to permit the cutting along the whole lengths of the shafts. The flanking clamps are tightened finally after having beer set horizontally by the grub screws. Springs throw the plates off the work.

There is no particular advantage possessed by the form at A, so far as the semi-circular recesses are concerned, over the vees in B and C. Possibly some may think the support would be steadier

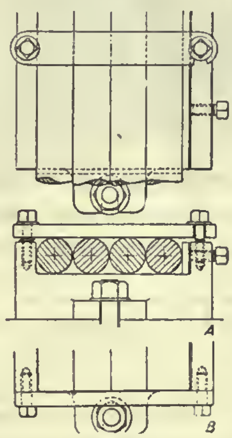


FIG. 4.

than that afforded by vees, but the claim could hardly be insisted on. The real advantage lies in the method of gripping the block, since it permits of the use of duplicate blocks, one of which can be loading on a bench or machine table while the tooling is proceeding on the other. The machine is thus kept fully occupied, instead of being held up during loading.

In Fig. 5 a method is shown of holding several shafts without inserting them in vees. From the plan and end view, A, it will be seen that the shafts are disposed side by side in a recess in the block, and are tightened laterally with set screws, pressing a loose strip against one of the outer shafts so pushing them all against the resistance offered by the abutment on the side opposite. A single hinged clamp plate bridges and secures them all. The plate, or plates if the block is long, are hinged on one bolt, to be swung aside, instead of lifted off, and the pivot bolt has a coiled spring. The clamp prevents cutting along the whole length of a shaft. An alternative then is to clamp laterally, as at A, but to exercise end pressure also, as at B.

A WRINKLE IN BRASS CASTING

In casting brass and some of the bronzes on the flat there is often a very great tendency for the castings to become "smoky,"as it is termed, this, in reality, being caused by a series of cold sheets in more or less developed stages. Assuming that the metal poured is clean and in a good fluid state, this points to the fact that too slow pouring has been used and waves of air have passed in with the metal, the remedy being obvious. As an additional precaution, however, it is well to adopt an uphill method of pouring, as shown in the illustration, the flasks being placed at an angle of roughly 20 deg. from the horizontal, with the ingate to the mould at the lower end. By this method the ingate is kept choked with molten metal, with the result that air cannot pass, and in combination with fast pouring, smooth castings should be produced. In most cases it will be found necessary to put in risers on projections as shown, so that not only shall air and gases escape freely, but also that any dirt carried to the higher points and there trapped may rise out of the way in the readiest manner.

This article was taken from "The Practical Engineer," and we will not attempt to throw a hint about where they got it, but by a strange coincidence we had it in CANADIAN MACHINERY in the issue of old 1918. Of course, there is nothing particularly new about the idea, but it is not generally followed, although it is the proper way to get a sound casting, either in brass or iron.

For an iron casting of this description, it would be best to cover the risor until the pouring was done, but with brass the risor should be left open for the escape of air.

GETTING OVER THE THUMB TACK TROUBLE

By Harrison Jenkins

It often happens that the usual system of placing your thumb tacks on the drawing-board becomes quite a nuisance, but if readers interested will employ the scheme shown in the accompanying illustration this difficulty may be easily overcome.

Of course such an idea as this is only applicahle where standard size drawings are made.

Merely counterbore a slight distance down in the drawing board, small holes. Bore these holes where the tacks come on these standard sheets, which naturally will be just clear of the trimming line. In this way you will have no further difficulty with raised tacks hitting your T-square, and even should the holding holes for tacks get pretty well used up in time you can easily insert wooden plugs or cork inserts, so that this fact should not deter readers from adopting the idea.

Two Interesting Fixtures Used on Automobiles

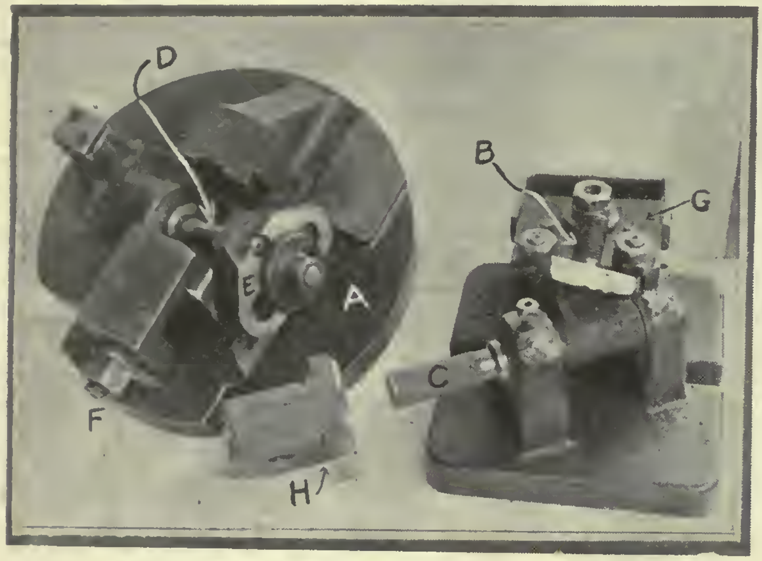
By J. H. MOORE

TWO very interesting fixtures are shown in the accompanying illustration. First, we will refer to the jig marked A. This is known as a turning fixture for the support spring bracket on the Overland car. The operation consists of turning, facing and threading the portion marked B. While looking at B, let us closely consider the peculiar form of this spring bracket. It is easy to realize that this is a difficult piece to hold in proper position, so in order to ensure rapid handling, the first operation consists in drilling and reaming the hole through which the pin C is placed in the photograph.

This hole being drilled and the bosses faced, makes the task a simpler one. The bracket is placed over the stud D and held in position by the clamp E. The complete fixture is bored and threaded at the back to suit the spindle of the lathe. The clamp F is also utilized in the holding of the work. Thus a difficult piece to handle is so arranged on a fool-proof jig to ensure both speed and accuracy.

The other fixture illustrated is used on a bevel milling operation on the same piece. It is necessary to mill a 45-degree bevel on this part, which must be absolutely accurate, owing to the fact that all the strain is taken on this face, also that this piece fits into the rear axle housing. Even a slight variation would mean that undue strain would come on the portion B, with possibilities of damage resulting, so that this operation is conceded to be a very important one. The pin C goes through the hole already described, while the portion G is slid in until it comes to a definite stop. The bracket rests on this slide, after which it is clamped securely in position.

To test the accuracy of work turned out on this milling jig, the gauge H is used. Workers are held to very close limits, being allowed plus one thousandth, with no minimum whatever. The nature of the gauge is such that the work can be passed on very rapidly. Placing the portion B through the hole in the gauge H, the lugs J and K at once determine the accuracy of the product turned out. Readers will, no doubt, be surprised to learn that such close limits are the rule rather than the exception in automobile manufacture.



TWO INTERESTING FIXTURES, BOTH OF WHICH HAVE PROVED VERY EFFICIENT.

Gear Gauges of Special Interest

By J. H. M.

THE testing or gauging of gear teeth is at any time a very interesting study, so that we feel sure our readers will be interested in the following description of various test gauges used at the plant of the Willys-Overland Ltd., of West Toronto.

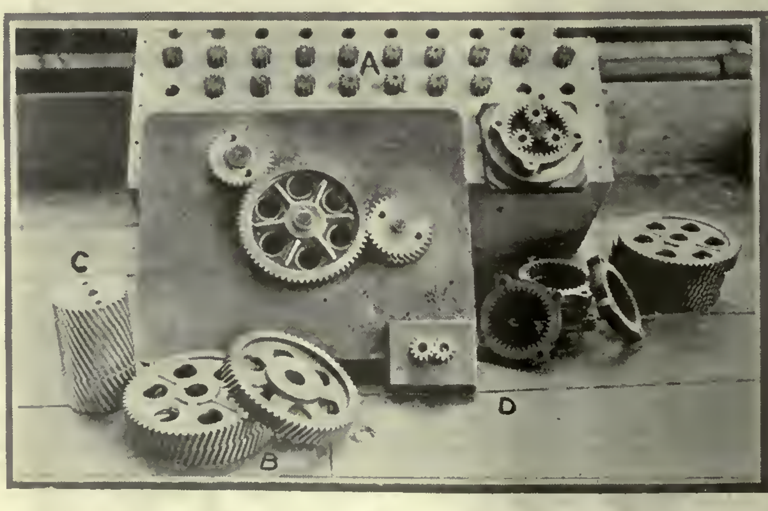
Perhaps, as good a plan as any would be to point out the technical names of the various gears shown in the illustration. The small gears shown on board at A are known as the steering shaft pinions, while the cam shaft gears are shown at B. The generator gears for crank shaft are shown at C, and the steering pinions at D.

The first gauge which we will consider is the one shown at D. Two differential steering pinions are placed on special studs on this gauge, and the pinions revolved to ascertain their smooth running.

The second gauge used is shown at E, and is used to test the timing gears. In this case, three gears mesh into each other, being placed on studs as before.

The last gauge illustrated is arranged to test the steering pinions, the three differential pinions, and the internal gear. The same principle holds good in this case also, the complete arrangement being mounted on a plate as shown.

This method of testing the accuracy of gear teeth has proved very successful, and ensures that nothing but the best of work passes the inspectors' hands. The majority of the gears cut at this plant are cut on gear shapers, which further aid in the high quality of the product turned out.



A GROUP OF GEARS WITH THEIR ACCOMPANYING TEST BLOCKS.

WELDING AND CUTTING

HINTS TO WELDERS

To readers not familiar with A. W. P. products, we might say that these electrodes, outfits, etc., for electric arc welding are manufactured by the Alloy Welding Process, Ltd., 14-16 Cockspur St., S.W.1, London, England.

The "A.W.P." electrode has only recently been placed on the market, but it has been used privately for some years, and has proved its value by reason of the excellent results obtained. In changing over from another type the operator will probably not feel "at home" with the first two or three electrodes used. He would, therefore, be wise not to condemn the electrode after one trial run, but pass judgment after he has welded with "A.W.P." electrodes for some little time.

Our electrodes are just as good on alternating as on direct current. The operator will, of course, be controlled by existing conditions as to plant, but if on D.C. from a separate generator adjust the voltage by the shunt regulator to as near 60 volts as possible. This lower voltage may make welding a little more difficult for the first two or three hours, but it will soon be noticed that there is a considerable improvement in the weld. With this low voltage it is necessary to keep a shorter arc, and that means better welding.

If welding with A.C., do not use a non-inductive grid resistance in your circuit to adjust the current. Try and get an adjustable choking coil, which provides the same variation in current in addition to steadying the arc and saving power.

Be guided more by personal judgment as to the current than by any set table; a higher current means quicker welding and a better weld.

The temperature of the electric arc is constant, and is not affected by the amount of current passing whilst temperature of the work depends on the length of time the arc is played on the work. The current only affects the quantity of heat generated in a given time, so if welding is carried on faster with a higher current the work will not get any hotter with a lower current for a longer time.

Use, therefore, as high a current as can easily be manipulated without burning through the metal.

When on work which comes under the regulations of any classification society (shipbuilding) you must be guided by their rules as to preparing plates, etc. On other work vee all close butt joints, and where welding can only be done from one side the vee should extend to the bottom of the plate. When welds are to be made on both sides of the plating the veeing need not be carried right through if the edges are left slightly open.

On plates of ½ inch or less, excellent butt joints can be made without veeing by leaving the plates 3-16 inch to ¼ inch apart, and making a light run down the back, or by using a light butt strap at the back if welding from one side only.

Except when working under society or local regulations, it will be found that with our electrodes there is no need to chip off the slag when making a second run of metal. Just brush away the loose pellets with a brush and chip a clean place to start upon. The slag will then flow well away from the fresh metal and come up to the surface.

In using the "A.W.P." electrode do not worry about the slag, which will be found to run so freely that it sometimes comes back behind the electrode. Moreover, the slag keeps running away from the metal, thus preventing the formation of slag-holes in the weld.

A NEW WRINKLE IN CARBIDE ECONOMY

By E. D. Bullard*

It is well known that calcium carbide will waste considerably when exposed to the air for an extended length of time. This slacking will vary, of course, with the duration of the exposure and the amount of moisture in the air. In some industries where huge quantities of carbide are used this loss is noticeable, especially in remote regions where transportation cost must be added to the purchase price of the carbide.

This is particularly true in tropical operations, due in part to the high humidity, and in part to the low intelligence of workmen who cannot be made to understand the need for careful handling of their daily allotment of carbide. This very serious waste has led to some interesting experiments in the large mining operations conducted in the Island of Sumatra. These enterprises are operated on a very large scale and employ many thousands of native miners, and tremendous quantities of carbide are shipped to them constantly from the United States.

Some time ago the writer was informed that the wastage from air-slacking at the Sumatra mines has been practically eliminated by the simple expedient of anointing all carbide with kerosene oil; each drum is opened and filled up with kerosene, which is immediately thoroughly drained off and used in the next drum. In this way an astonishingly small quantity of oil is expended, and yet each lump of the carbide is coated with it and completely insulated from the atmospheric moisture. In this state the carbide will not slack at all unless brought into contact with water. It can be carried in sacks to distant points, by prospectors, for instance, or for the use of construction gangs with flarelights, etc. There is no loss from slacking unless the carrier gets caught in the rain, drops his load in a stream, or, in a word, allows water to reach the carbide. In such a case the carbide will become a total loss, of course.

The point is that atmospheric moisture affects the carbide thus treated not at all. In the lamp or generator, however, there is no loss of acetylene through the presence of the kerosene envelope. Indeed, there is, presumably, some added heat in the flame due to the kerosene vapor generated by the heat of slacking when the water reaches the carbide.

Of course there is the expense of the kerosene that adheres to the carbide, but this is said to be quite insignificant compared to the great saving in carbide.

This method has been very well tested out at the Sumatra mines and in generally adopted there. The atmosphere of that country is exceptionally humid and the loss of carbide in the old days was proportionately great. The writer has tried it out very thoroughly, also. He carefully cleaned and dusted two pounds of ⅜ inch (mine-lamp size) carbide, coated it well with kerosene, which took approximately one fluid ounce, and set it out spread thin to a day of hot sunshine and strong ocean wind, and a night of heavy San Francisco fog. There was no loss of weight and no slacking dust after this exposure. Not even the slightest odor of carbide could be detected when the pan was finally brought in from the window-sill; only the slight smell of the kerosene was present. The treated carbide was then subjected to a burning test along with untreated carbide in every type of mine lamp. It gave off gas freely and burned as long, or longer, than the untreated carbide, and gave a perfectly clear flame. On cleaning the lamps the sludge was in no way different from that of the untreated carbide.

*From Acetylene Journal.

WHAT OUR READERS THINK AND DO

EQUALIZING GEARS FOR BUCKET CONVEYORS

By John S. Watts

Any engineer who has operated a bucket conveyor driven by plain gears, knows from painful experience the heavy strain put on such mechanism by the uneven velocity of the conveyor. The reason for this unevenness is that the links of a bucket conveyor are relatively long between centres of pins, and therefore the driving sprockets, to be of a reasonable diameter, are generally made with only six teeth. This, with plain circular gears, gives the buckets a maximum velocity equal to $\pi \times D \times$ R.P.M., and a mean velocity of $3 \times D \times$ R.P.M., D being the diameter of the sprocket from centre to centre of link pins, or in a six-tooth sprocket twice the length of the link centres.

This can be proved from a perusal of Fig. 1 by noting that the centres of the link pins in one revolution of the sprocket travel a distance equal to the circumference of a circle whose diameter is D; i.e., a distance of $\pi \times D$, while the actual travel of the bucket chain in the same time is only the length of six links, or $3 \times D$.

To overcome this effect, it is necessary to have the driving sprockets revolve at a speed which will vary the amount necessary to give a uniform velocity to the buckets. While this causes the driving sprockets to have an unequal speed, the mass of the sprockets is so small relatively to the mass of the buckets and chain that this uneven velocity is of no importance.

In all that follows, we assume that a six-tooth sprocket is being used, but no difficulty would be found in working out the problem for a sprocket with more or less teeth by using the same reasoning.

As the peripheral velocity of the sprocket must vary from the minimum to the maximum and back to the minimum six times per revolution, it is essential that the ratio of gear to pinion be some factor or multiple of six, and will generally be six. Now, this ratio of six is the mean ratio, and a pair of gears can be decided on which will transmit the required horsepower, using the usual formula and neglecting for the moment the equalizing effect required. The general dimensions of the pair of gears being decided, we have the distance centre to centre of gear and pinion, which distance we lay off as shown at C in Fig. 2; on this line describe a circle whose radius is $\frac{6 \times C}{7}$, which represents the mean pitch circle of the gear, which is the same as it would be if we intended using a plain circular gear.

From the above it follows that the maximum peripheral velocity of the sprocket should be $\frac{\pi}{3} = 1.0472$ times the mean velocity, and should occur six times per revolution. Now the mean gear ratio being six, the maximum gear ratio will be $6 \times 1.0472 = 6.2832$, and the short radius, a, of the pinion will be

$$a = \frac{C}{1 + 6.2832}$$

From centre line of pinion shaft lay off this length a, and from this new point measure back the radius of the pinion pitch circle as already decided and describe pinion pitch circle as in Fig. 2. Note that the pinion is truly circular but bored eccentric by an amount equal to $\frac{C}{7} - \frac{C}{7.2832}$; the centre of pinion shaft being exactly where it would be for a pair of plain circular gears.

Next lay off centres of teeth on the pitch circle of both pinion and gear, projecting the latter out to the circle drawn through the centre of the pinion shaft.

Now measure lengths from centre of pinion shaft to centres of teeth on pinion pitch circle, as at a, b, c, etc., Fig. 2, and lay off these distances inwardly from circle through centre of pinion shaft on lines projected through tooth centres on mean pitch circle of gears as shown. Through the points so found draw a curve which will be the required pitch line for the gear. In other words the pitch line of the gear is described by graphically rolling the pinion pitch circle around the gear.

Only one 60° segment has been worked out in Fig. 2, as the other segments are all duplicates of this one.

The teeth of the gear can be now laid out by the usual methods, using the curved line for the pitch line.

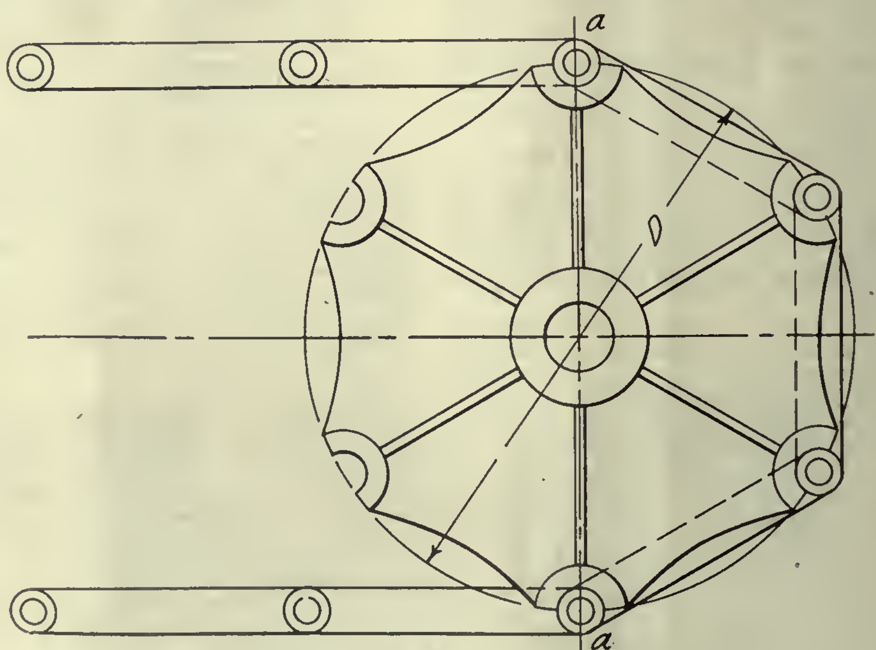


FIG. 1.

It will be found that where the gear ratio is half the number of teeth of the sprocket, the pinion pitch line will be elliptical in shape, as then one revolution of the pinion will take two points of maximum velocity and two points of minimum velocity.

In erecting these gears, care must be

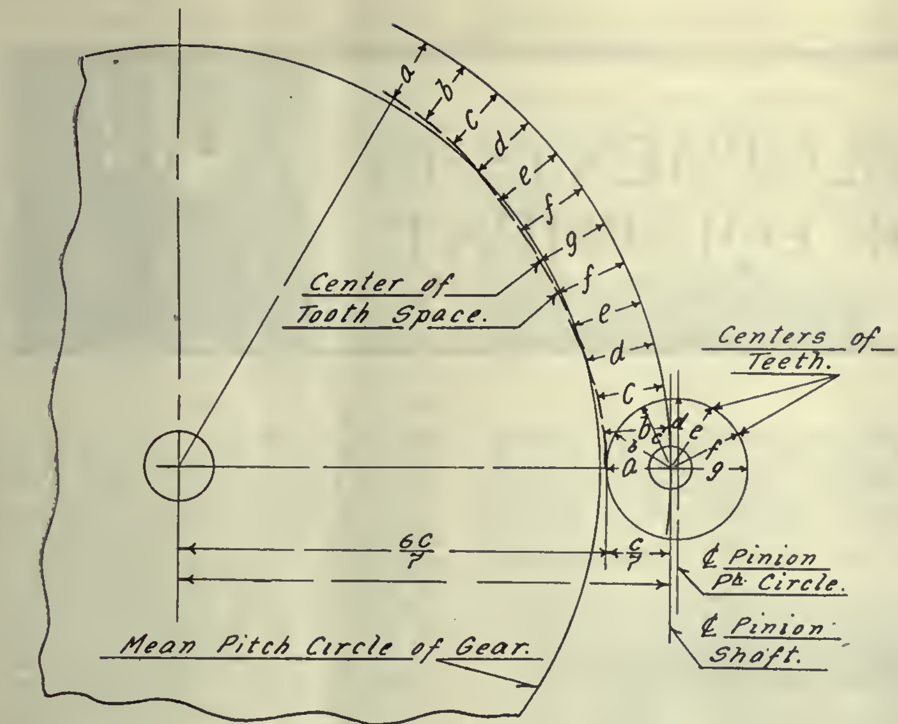


FIG. 2.

taken to get the gear and pinion set so that tooth "a" on pinion meshes with one of the teeth spaces marked "a" on the gear.

Also, in keyseating the gear and sprockets, the work must be done so that the centre lines through the points of maximum pitch diameter of the gear, i.e., at "a" in Fig. 2, are in the same plane as the centre lines through the sprocket teeth marked "a" in Fig. 1.

GRINDING CHUCK FOR GEARS

By J. H. Moore

A very interesting grinding chuck is shown in the accompanying sketch. This chuck is used at the plant of the Machine and Stamping Co. for the grinding of some of the gears on the differential for the Overland Four car.

As will be noted, the chuck really grips on the pitch line of the gear teeth in this way, ensuring absolute accuracy. The chuck is of the collet construction, pulling up in the regulation manner. When very accurate work is desirable one cannot do better than follow out the principle shown in the illustration.

After the gear is chucked in the method described, the centre hole is ground out on a regular style machine.

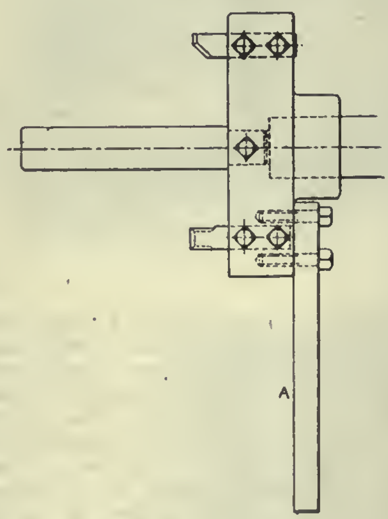
PERSONAL

E. L. Cousins, the energetic manager of the Toronto Harbor Commission, will leave Toronto at the end of January for a trip to England. He will, while over there, endeavor to secure new industries for the city, particularly for the sites which have been developed by the Harbor Commission.

Death occurred very suddenly to Mr. William Ross, general superintendent of the Phoenix Bridge and Iron Works, Montreal. He was stricken on Windsor street while on his way home, and died immediately. Death was due to heart disease. Mr. Ross was born in Ontario about seventy years ago. He held the position of general superintendent for the last twenty-three years. He is survived by a widow.

The death is announced from Montreal of David Robertson Stewart, deputy port warden of the port. Mr. Stewart was a native of Liverpool, England, and was 39 years of age. Until about 15 years ago he followed the sea, sailing in the Beaver, Elder Dempster and Canadian Pacific Lines. He then joined the shore staff of the C.P.O.S. and was appointed deputy port warden of Montreal in 1914. He was a member of the Waverley Lodge, A.F. & A.M., and of the St. Lawrence Curling Club. He is survived by his widow.

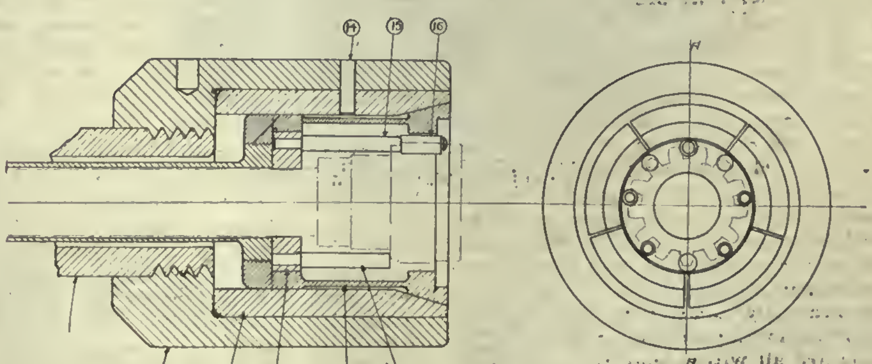
The Taylor Instrument Companies, Rochester, N.Y., have issued the 1919 edition of their General Industries Catalogue of Tycos instruments. This catalogue lists the temperature instruments manufactured for the requirements of manufacturing and industrial operations. Thermometers of all types, hydrometers, viscometers, pyrometers, both indicating and recording, temperature control apparatus are listed, and a valuable feature of the catalogue which will commend itself to the engineer is thirty-two pages of ready reference tables applicable to industrial uses.



USING TOOL HEAD ON POPPET BARREL

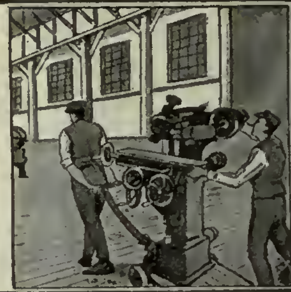
By J. HARDY

The plan view illustrates an arrangement that was devised to do a part of the machining of a casting on an engine lathe, the pair of tools, for recessing and chamfering, being fed up from a casting fitted over the nose of the poppet barrel. A pilot bar centred the head. As a means of taking the torsional effort without imposing any strain upon the barrel spline or its key, the dodge of tacking on a piece of bar, A, was adopted, this bar lying on the top of the lathe bed, a practice that answered successfully.



SECTIONAL VIEW THROUGH THE CHUCK.

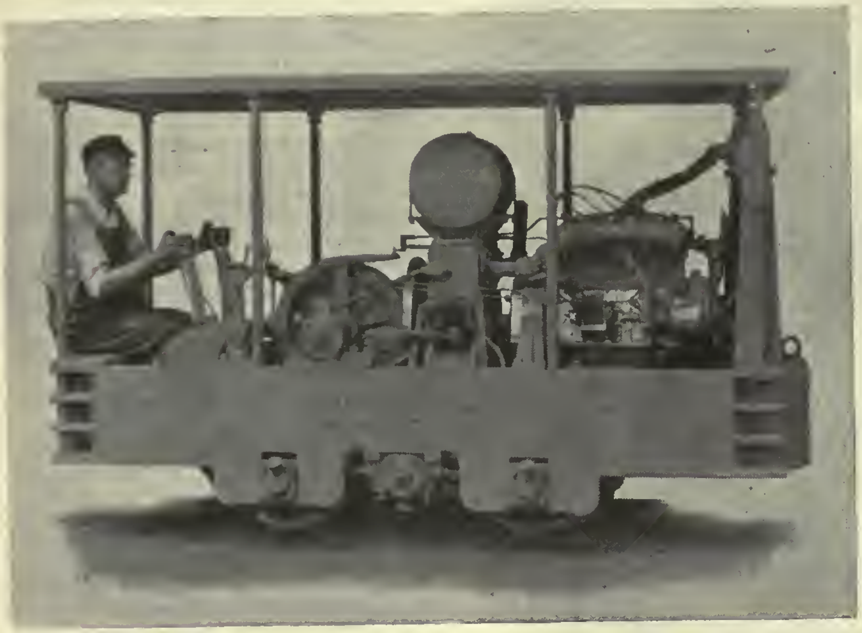
DEVELOPMENTS IN SHOP EQUIPMENT



BURTON LOCOMOTIVES

The Burton Engineering and Machinery Co., Cincinnati, Ohio, have placed on the market a line of gasoline and kerosene locomotives suitable and adaptable for any gauge track.

The cab is of wood and metal construction, extending the entire length of the locomotive, providing ample room for the operator, and giving free access to all parts of the locomotive. The motor is the latest type of Herschell-Spillman,



GENERAL VIEW OF THE LOCOMOTIVE IN ACTION.

four-cylinder cast in block, equipped with Bosch high tension magneto, zenith automatic carburetor, Pierce mechanical-driven governor, and radiator with cast iron shell, honeycomb core, spring hangers, which absorb all shocks, which a machine of this type is subject to. There is also a guard in front of the radiator to protect it from damage by articles protruding from cars in actual work. All complicated parts such as gears, differentials, clutches, licensed engineers, are eliminated. It has any speed forward or backward with equal power in both directions. All parts are accessible for cleaning and adjusting.

These locomotives are designed to operate with either gasoline or kerosene, and are built in sizes ranging from 3½ tons to 12 tons. Simplicity of construction and operation are the essential features as the power is transmitted through a spur friction, 22 inches in diameter, on a large shaft carried on Hyatt heavy duty bearings.

The jack shaft is on heavy duty Hyatt bearings driven by steel roller chains having ¾-inch rollers, 1¼-inch pitch, and the final drive to semi-steel wheels with chilled flange and rim ground to a true running surface. These wheels are pressed and keyed on special axles which are mounted on extra large Hyatt standard bearings in journal box, carried on coiled springs of the proper size to insure smooth running, with ample provision for lubrication. Steel roller chains and cast steel sprockets are used throughout, eliminating all gears.

The friction control is operated by hand lever, brake by hand lever, speed chains by special locking device, and engine controls are all within easy reach.

Brakes on all wheels have a special equalizing device with large cast-iron brake shoes. This device has a powerful leverage, capable of locking all four wheels by means of hand lever conveniently located for operator. Another very important feature of the braking system is the sand device. The sand box is so located that the exhaust from the motor passes through the same, keeping the sand hot at all times, and in a condition to run freely. The control of sanders is by foot pedal, conveniently located for the operator.

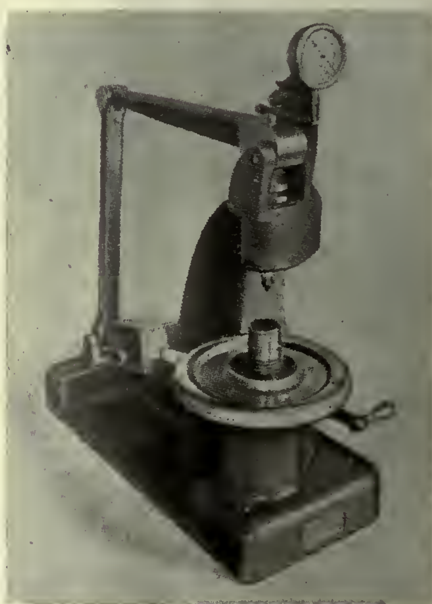
Another important feature is the cooling system, which is thermo-syphon, with radiator located in front of motor. The radiator is of a large capacity with cost iron shell hung on a special shock-absorbing device. One of the special features of the cooling system is the reversible fan blades which automatically reverse when the locomotive is run backward or forward. This insures cooling at all times.

The control by friction drive is conveniently located and the friction disc is protected from grease and dirt by a cast iron shield.

HARDNESS TESTER

S. P. Rockwell, 122 Dickerson St., Syracuse, N.Y., has placed on the market a hardness tester for use in testing the hardness of all kinds of metals by the Brinell method.

It is claimed that this machine gives very accurate results and that it is adapted for testing both curved or flat surfaces and either thin or thick sections. It operates rapidly, and may be carried around without trouble. Another important feature is that it does not excessively mark or destroy the



ROCKWELL HARDNESS TESTER.

work on which a test is made, and that the machine is adapted for testing the hardness of all metals ranging from lead to hardened steel. The machine consists of a sturdy hollow cast frame and a plunger, which holds the testing point at one end and abuts against a delicate measuring device at the other end. A series of levers with knife-edges connects this plunger with a weight, and by shifting the position of the weight, more or less force may be applied to the testing point to suit conditions.

A vertical movable chuck holds the piece on which a hardness test is to be made, this chuck being actuated by a handwheel. The piece to be tested is placed in this chuck and raised by the handwheel until it comes into contact with the testing point. At this moment, the initial pressure is applied through the point to the work, in order to cause the point to break through the light scale, decarbonization, etc., so that it may more clearly test the condition of the true metal beneath. Upward movement of the work is continued until the plunger has actuated the measuring device to a degree sufficient for testing; then the final weight is applied by a hand-lever, and the hardness is read direct by the difference of the testing point's position as indicated by a measuring device. The elasticity of the metal may also be determined by the test point's difference of position from final pressure to initial pressure.

With an equipment of this kind, an average operator can readily make six tests per minute. The greatest value of this machine for shop use is as a comparative tester. For such work, hardness limits are established by the Brinell, scleroscope, file, or working tests, and the Rockwell hardness tester is then set for the particular class of work on which it is to be used, and its limits are established. If so desired, the indicating dial can be calibrated in Brinell, scleroscope, or percentage hardness numbers, using electrolytic iron as zero per cent. soft. Such dials are available as a special equipment. All work has allowable variations in hardness, and for fast operation of this instrument an extra pointer may be provided. The angular difference in the position of the two pointers represents the allowable hardness variation; and if in operation the two pointers straddle the graduation indicating mean hardness, the work comes within the specified limits. Failure to straddle the mean graduation indicates that the work is too hard if the pointers are on one side, or too soft if they are at the opposite side.

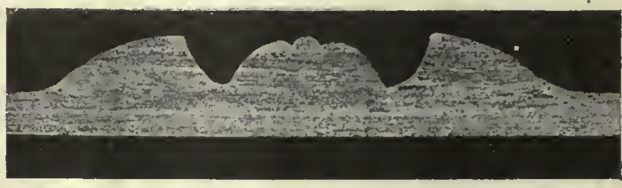
In view of the increasing need for readily applicable means for hardness testing, convenient and simple to operate, the machine described constitutes an interesting development which will, in addition to other means already available, make it possible to control the quality of manufactured articles, especially those subjected to various heat-treatments.

SHAPER ATTACHMENT

The Stockbridge Machine Co., Worcester, Mass., have placed on the market an irregular curve attachment used in conjunction with their shaper. The illustration with this notice explains matters

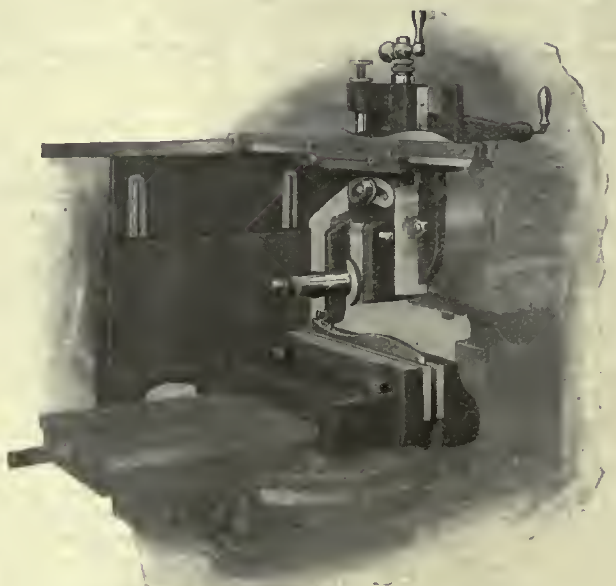
ONE STYLE OF CURVE.

fully. This attachment is used to plane or shape curves, and ensures absolute duplication, on split dies, and other similar classes of work. Forming dies and blocks for a large variety of work are easily shaped and duplication possible any time when required.



A PECULIAR SHAPED PIECE PRODUCED BY THE ATTACHMENT.

The larger class of work in which this attachment is found a necessity is, of course, die work, bending forms and formed tools, but many special jobs that are difficult of machining can be done with this attachment and cost reduced. The illustrations indicate in a general way the possible range in curves and angles that can be reproduced. It will not only reproduce the curve of the templet once, but over and over again



VIEW SHOWING THE ATTACHMENT IN OPERATION.

at one setting, or at any future time reproduce the identical shape of the original.

The templet carried in the cross-slide holder is made from about ½ in. x ¼ in. stock shaped to the required outline of surface to be duplicated. The cutting tool is directly beneath the follower and it is raised and lowered as the follower moves along on the surface on the templet and reproduces its curves and angles.

Attachment can be furnished with all sizes of Stockbridge shapers; it is interchangeable with the regular Stockbridge shaper head and can be furnished either on the shaper without regular head or as an addition to regular head.

Many of the formed tools used on automatics can be shaped to good advantage and at a large saving over the usual methods.

As the result of a series of experiments on twist drills, recently undertaken at the engineering experiment station of the Illinois University, the following lubricants are recommended:—For tool steel—lard oil, machine oil, turpentine, soda-water, kerosene; for soft steel—lard oil, machine oil, soda-water; for cast iron—dry or compressed air; for brass—dry or paraffin oil; for aluminium—kerosene, soda-water, and aqualine and soda-water. Various compounds are also suggested, such as:—For steel—boil together lard oil one-third and soda-water two-thirds; for steel — heat together borax 7 lb., and water 40 gallons. When cool add 7 gallons of lard oil; for steel—a thin drilling compound, almost water—enough compound to make smooth and to prevent rust; for aluminium—half kerosene and half lard oil.

A Peep Into the Future; Ford Is Outdone

Mechanical Inventive Genius Will Undoubtedly be Equal to the Tasks Imposed in Future Years as Witness the Following Article. We Are Indebted to "The Engineer" for This Flight of Pure Imagination

A Christmas Story of 1930

WHEN Mr. James Mass asserted little more than a year ago that he was prepared to flood Europe with a £50 motor car, he was regarded rather as a madman than a knave, but when he began actually to find capital by the simple expedient of accepting fully-paid orders for cars which he had not even begun to build and for the construction of which neither the works nor the machinery existed, opinion veered round to the opposite point, and there were not wanting those who dubbed him a rogue and a charlatan practising on the gullibility of the public through a remarkable personality. So strongly at length did feeling run when it was obvious that more than the twenty million pounds would undoubtedly be subscribed, that deputations waited upon Cabinet Ministers to implore them to take steps to stop this wholesale robbery of the public and to prevent the kingdom being made the laughing-stock of the world. But the Government took no action, possibly because the members themselves had ordered their Mass cars, or possibly because they recognized that whether the people were fools or not, they were carried away by the daring Mr. Mass, convinced of his honesty and determined at all costs to support an enterprise which, if it were successful, would put the kingdom in the forefront of industrial pioneers, and which, if it failed, would cost them no more than the price of a few suits of clothes.

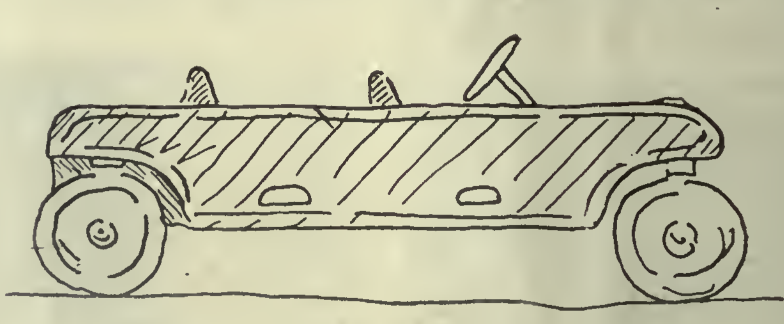
Within a month of issuing his prospectus Mr. Mass was sure of his capital; before three months had elapsed the vast factory at Aston began to rise from the ground, and nine months later the announcement was made that the first batch of cars had been completed, had run their tests on the private track of the company, and had been placed in the bonded store where they are to remain until the day when ten thousand are ready for simultaneous delivery. That day is now rapidly approaching, and it is confidently expected that before the month is out Mr. Mass will have replied effectively to all his critics, and that those who were daring enough to set the example to others by investing their money will be the happy possessors of cars as remarkable for their design as for their method of production.

It is well known that Mr. Mass has insisted on the preservation of the closest secrecy about both the factory and its product, and that every member of his staff and every one of his workmen have entered with as much zest into this condition as they have into the endeavor to realize the aspirations of the great inventor. We believe we may say with precise truth that up till a few days ago not a single soul outside the Aston factory knew how the £50 car was made or what it was like. That Mr. Mass has consented to allow us to lift the corner of the veil, we must ascribe as much to the fact that in a few days' time ten thousand Mass cars will be on the road, as to the flattering reasons Mr. Mass gave us. Even now we should betray his confidence did we give more than the broadest description of the works and of the car, and to tell the truth we are not, in any case, in a position to do much more, for causes which will appear in their proper places.

The Mass Car

First, as regards the car. Chatting about it to Mr. Mass before our all-too-hurried inspection of the factory, he sketched its outline on a scrap of paper, and as that rough sketch may some day have historical interest, we give herewith a facsimile reproduction.

The reader will be at once struck by the extreme severity of its line; he will observe that there are no doors, no splash guards and no visible springs, and if a back view were presented he would be astonished to see no back axle and no differential, whilst in the front view he would see no steering gear. As a matter of fact, the body is a box without any of the projections from the bottom or sides to which we are habituated. The traveller enters it by stepping in over the side, indented footsteps being provided to assist him. The omission of doors has a two-fold effect; in the first place, it reduces cost materially, and, in the second, it admits the characteristic feature of the Mass car, which is the employment of the body itself as the chassis framework.



THE MASS MOTOR CAR.

The body is built of two deeply pressed steel sides held together by the bottom and ends, and by four hollow transoms, one at the back of each seat and one just under the knees of the travelers. It forms, thus, a very stiff framework. The four wheels are quite independent, and each is carried on a stub axle, from which, by the way, it cannot be separated. Each stub axle is provided with a vertically projecting rod or plunger on which a helical spring of special design is threaded. The spring and plungers enter tubes welded into the body. To the summits of the front plungers the steering levers are attached, and they are thus entirely enclosed and out of all danger of shock or dirt. The plungers of the driving wheels are coupled by a pair of hinged transoms, thus forming a jointed frame. Between these two transoms is placed the engine, which drives straight on to external helical gear on the wheels. One word must be said about the wheels. They are of the pressed disc pattern, and the tires are a permanent attachment to them. It is only a few years since the pneumatic tire went finally out of use, but it is hardly necessary to say that the tires on the Mass car are not pneumatic.

The Engine

The engine baffles us—though we have our suspicions—and the best course in dealing with it will be, perhaps, to reproduce as nearly as we can recall it, our conversation with the inventor.

"Placed as it is, Mr. Mass, your engine must be of very remarkable design?"

"Yes, it departs altogether from normal motor car practice. All that is visible from the outside are three somewhat similar steel casings. The first we call the generator, the second the motor, and the third the condenser."

"It is not an internal combustion engine, then?"

"Certainly not what is generally meant by an internal combustion engine."

"Might it be described as a steam engine—or steam turbine, perhaps?"

"It would be wrong to do so, for steam is not used in it."

"You excite our curiosity. May we make one guess? A mercury vapor engine?"

"What, with mercury at its present figure! Half the price of the car would go in mercury."

"Can't you give us just a little hint?"

"Did you ever hear of Arnostedium?"

"The liquid metallic alloy? Of course, but—

"Now, no more questions on that route. Switch off. You want to know why there is no differential. I will tell you. Because there are virtually two engines, one to each wheel, although the harmony between the two is automatic and perfect."

"But you make the engine harder than ever to understand. It can't be a turbine—

"You will have to amuse yourself thinking it out."

"I shall buy a car and see!"

"I'm afraid not. When the parts of the motor are in place the casing is electrically welded up."

"But what about repairs?"

"There are no repairs on a Mass car. If you want a new engine, send us back the old one and seven pounds ten. If you want a new front wheel, drop the old one out and return it to us with thirty shillings. We replace parts en bloc, not details, and we set our face against repairs, both because they are absurdly costly and because they are dangerous. When you are using the remarkable materials we employ, to entrust the heat treatment to a wayside smith is just looking for disaster."

"Do tell us one more thing about this fascinating motor. The fuel?"

"A solid fuel. Endothermite."

"Endothermite! You are joking. It is far too dangerous."

"It is far less dangerous than petrol. I agree that ignition once started is irresistible, but consider how difficult it is to start it."

"How do you start it."

"Now, now," said Mr. Mass playfully. "Break away there and come and see how we put our cars together."

The Works

We descended in a lift, and crossing a yard that was a model of tidiness, entered a doorway on the ground floor of a five-storey building. There are at present twenty of these buildings, all exactly the same, both internally and externally, and there is space for the accommodation of at least as many more. A branch railway runs across the front, and brings the raw material to the very doors. At the other end ramps run down to the charging and dispatching houses and to the great store. Around the works extends a trial course, now completely enclosed by hedges and hoardings, so that none of the cars are visible to the public.

In front of the building we entered stood a train of railway wagons full of steel plates. A bundle of these plates was picked up by a magnetic crane and carried right into the shop, where it at once entered a machine which automatically cut the ties and separated the plates. Leaving this machine on a conveyor, the plates were carried in rapid succession to a series of gigantic presses, from the last of which they emerged in the form of one half of a body, with half ends and half floors included. A series of presses lying parallel to the first and working in absolute unison with them was producing similar sides. Two parts left the last presses at the same moment, were brought together by the convergence of the conveyors, and entered the assembling and welding machine. Here nothing was to be seen, but on leaving the casing in which the operation was conducted, the two parts were completely welded into a single part. The car body was then transported to another machine which was connected to the floor above by four trunks. Down these trunks, Mr. Mass informed us, descended the four transoms already referred to. They were guided automatically into their correct positions, and were welded on with the ease and regularity of soldering cans in a tinning factory. The bodies then entered a final welding machine, in which the tubes for the springs were attached, and as they emerged from the end we caught a glance of them in their rapid passage to the painting enclosure. Here they were painted all over, inside and out, by spraying. They then entered a drying chamber of great extent, into which we peeped through glass windows.

Fifteen minutes is sufficient in this room to harden the special paint used. The last operation on the body is lining out, which is performed by paint wheels carried on long arms. The body leaves the final drying room bottom upwards.

The Erecting Towers

We are all familiar with erecting platforms of the Ford type. They travel horizontally. At the Mass works the movement is vertical; and for this reason: The various parts are made on separate floors; to bring all the parts to one floor would cause waste of time. The crescent car passes through the floors and picks up its parts as it goes. Each floor has its own moving platforms which lead to the erecting towers. The journey of the car through the towers is not continuous, but intermittent. There are eight floors in all, four up and four down, and it stops at each floor for about five minutes. In other words erection is completed in forty minutes. The same men, four in all, travel with it the whole way in each tower. At the first floor the wheels with springs are put in position; at the second the engine is dropped into place; at the third, the generator and condenser are fixed; at the fourth, the brakes are fitted and the final adjustments under the car are made.

Up to this point the car has been upside down—a very convenient position for the work to be done. The up-gang of erectors now leave it, and the conveyor carries it round a bend at the top of the building to the down-tower, which it enters in the upright position, standing on its own wheels. In its passage down it receives its upholstery—all made as separate items and attached by clips to the body—steering gear, lighting units and lamps, brake lever, fuel container, etc., and all the connections to the dash—which, by the way, is attached as a single unit—are also made. When it reaches the bottom again it is a complete car and runs on its own wheels to the filling shed. There it receives a charge of endothermite and passes to the running shed, where it is at once boarded by a chauffeur, who takes it out immediately for a run of fifty miles round a special track provided with all sorts of devices for testing every part anl all the qualities of the car.

Fitting, etc.

We have seen something of the manufacture of the parts of the car, with the exception of the engine, but are not permitted to say anything about it. The principle is mass production throughout on highly specialized machines. Some of the tools are like gigantic full automatics. The stub axles, for example, go in as rough drop stampings and emerge machined all over and are borne straight off to the hardening shop and thence to the grinders.

We were informed that not a single gauge is to be found anywhere in the shops, and that not a single measurement of any kind by anyone but a tool setter is permitted. Mr. Mass holds that no gauges are so good or so cheap as the parts themselves. He says that if you make one hundred parts that have to fit another hundred parts, and you take one or two pairs at random and try them together, if they fit it is certain as can be that all the others will do so, too. To put this principle in practice, light high-speed runways traverse the machine shops. Every now and then a boy snaps up a part and drops it into a tray on these runways. It is carried forward to another part of the works, where another boy takes it and tries it against the part it has to fit. Exchange of this kind goes on continuously all day. In the event of a part failing to fit, the boy informs the foreman, who presses a button, and instantly all production of all kind in that building is arrested. This happened two or three times in the early days of manufacturing, but Mr. Mass told us that not a single case had occurred for three months, and he does not see why one should.

Of course, there is no drawing-office in the factory—there is one in the tool works—for there is nothing to draw, and Mr. Mass is resolved that there shall not be. No alteration of any kind will be permitted in the car for at least five years, when he hopes to have written off his whole capital, and can then think about changes—if any are needed

After this all-too-hurried survey of the factory, we returned to Mr. Mass's room. It would be wrong to call it an office, for Mr. Mass holds that the rooms in which we have to pass a very large part of every day should be as attractive and comfortable as those in our homes. "Now, tell me," he said, as we settled down to a cup of tea, "what struck you most in the factory?" We replied that though we felt it was not what we were expected to say, the things that had given us the greatest surprise were the lack of haste and the lack of noise. He appeared to be delighted with the answer.

"The essence of all progress, the essence of all science," he exclaimed, "is harmony. The music of the spheres is not audible music, but the harmony of movement of the stars in their courses. The beauty of a machine is of the same order—observe the harmony with which the corporate parts interact. So, too, with science of all kinds; the laws of all science are harmonious, and if any law seems to clash with other laws, if it makes a discord with them, we know it is at fault. A great factory, this beautiful factory you have seen to-day, is founded on harmony. All the parts fit together with perfect concord. Of course, there is no hurrying; why should there be? Hurry is the result of a lack of harmonious arrangement. If you tether a donkey with a hackney, the donkey will have to hurry and strain to keep up, but put two hackneys together and they work together with an ease of effort that gives us pleasure to observe. If part of these works were slower than other parts, the slow parts would be donkeys. The secret of success is for all parts to work at the same pace. The departments of this factory are geared together with the exactness and precision of the wheels of a watch. That is why you saw no hurrying.

"You perhaps observed that the factory is cut up into twenty exactly similar units, and perhaps wondered why it was. Let me tell you. Suppose there were twenty men with but one stomach between them; if that stomach got a pain in it, all the men would be laid up at once. But if each man had his own stomach—you see, of course. Each unit of this factory is complete in every detail; it has its own power-house, its own staff, its own operators, its own railway lines, its own plant. Each delivers its quantum of cars quite independently of the others every day. They all feed the common store. The only other things in common are a single selling agency and a single purchasing agency.

"Let us turn to the question of harmony. All our workpeople are in harmony. You will have noticed that there are no women or girls about the factory. Sex is prone to cause discords—that is why. Every man in the place is an original shareholder; every one paid his £50 for his car, and all will receive their cars in due rotation. There is not a man in the place that belongs to a union or is classed as a workman. They are all well educated, many of them highly educated, and without exception they have a taste for art in some form or for literature. They can do anything in the factory, and they all do; we all can. If a man falls sick, it is sometimes my privilege to take his place. I enjoy a week or two in the towers immensely, and the members of whatever gang I happen to be working with treat me exactly like their missing fellow. Sometimes I get terribly chipped because I am a bit clumsier than the regular hands. By moving the men from one job to another their interest is maintained, but nearly all the work is, as a matter of fact, fairly interesting. At least, there is no monotonous drudgery. Whenever drudgery has to be done we get a machine to do it. At first I bought the few chains we used, but when I had seen them being made I resolved never to buy another. Go to a chain factory and you will understand why. It is hateful to me to see a woman or young girl seated all day, week after week, pushing little bits of steel into a punching machine. It is gross degradation of humanity. Machines make all our chains from start to finish. They are complicated machines and the men take great pleasure in them. You saw our little axles being made. In most works single-operation lathes operated by girls would be used for such work. Here you saw them finished complete by machinery.

"You saw also our system of inspection and noticed our nippers picking up parts here and there, and chucking them into the conveyors. Happy young rascals! They only work in the shops for two hours a day—the rest they spend in our school where we are making future men of them—and as you may have noticed, they enjoy the sport. We put lads on the job because we want a little mischief in it. The more tricks they get up to, the more completely they test our interchangeability. The conveyor system keeps a measure of control over them, and their masters, who go into the shops with them exercise beneficent restraint.

"One word more, and that on the question of noise. Noise is absolutely abominable to all of us, both because it is inharmonic in itself, and because it simply shouts of inharmony in the machine producing it. A perfect machine is noiseless. We have not yet reached that state of perfection, but I am delighted that you noticed we were getting near to it.

"There, there, I am monopolizing the conversation, but it is your own fault, you appeared to be interested."

We assured him that we were.

"Are there any points you would like me to explain?" he asked.

"Many," said we. "First, there is the engine. The patent drawings—"

He burst into laughter. "There is not a single patent in the whole car."

"What!" said we in surprise.

"Not one," said he. "After June 1st any one that likes may copy our car. It isn't patents that make success, but the means of production. We have got the start of the world and defy others to catch us up, let them try never so hard."

As I rose to leave him, I addressed a final question.

"No, sir," he said, "we have no agents, but we are arranging depots for spares all over the country. Good-bye. Do come on June 1st and drive one of the cars. There is nothing to learn. Good-bye; good-bye!".

ACCURATE GAUGES OF PLASTER OF PARIS

By Donald A. Hampson

Every business has its pivot men—men who are scarce and about whose skill the whole fabric swings—men who correspond to the tenor of the opera and the baseball pitcher. In the manufacture of straw hats, there are two such positions and one competent man in each takes care of the wants of a plant of about five hundred other employees. These men are known respectively as the "whittler" and the "moulder."

The whittler is a wood carver de luxe. His work is to make wood patterns or models for all the various sizes and shapes of hat crowns and brims, to make plaster of paris casts from these, duplicates and many other parts that require the hand and eye of an artist. The moulder makes spelter dies from the plaster casts and dresses them up to a degree of smoothness and fit. These dies go in presses and the sewed forms are then pressed into hat shapes to suit the modes of a season. (The hat business uses or has used practically every mechanical movement in its presses and various hydraulic and steam presses as well.)

A whittler named Blake was one of the best in the business and, being mechanically inclined, had devised many improvements in other branches of the work than his own. His broad experience made him a man sought after and he frequently contracted for a year away from the home shop.

It was while he was thus working several hundred miles away that I made the acquaintance of his plaster of Paris gauges. Our experience in the line and the patterns we had gradually made up brought us repair work from distant points. Usually the old parts were sent, but Mr. Blake's method was to make a cast in reverse of the part wanted and send that to go by for the important measurements.

The male piece was always just the size the slot should be planed in the mating casting, and the female piece just how much freedom should be allowed for a sliding fit of the tongue. Without knowing it, some of these gauges that he made were of surprising accuracy, and the fact that they were unaffected by temperature was an important item. Though this man never saw a micrometer, these parts, which he would call ordinary work, could not be made closer than 0.001 in. than they are and show the kind of fit that is wanted.

All of which goes to show that there are other ways than ours, and that this one might sometimes be copied by machinists in general

The Betson Plastic Fire Brick Co., Inc., Rome, N.Y., have issued a folder descriptive of the Betson one-piece permanent baffle for water-tube boilers.

Troubles in Electric Furnace Operation

Mechanical and Electrical Features of Furnace Design Which Are Liable to Give Trouble if Not Guarded Against. Most of These Are Simple in Themselves, But Cause Much Inconvenience

By W. F. SUTHERLAND

NOT so very long ago an engineer who ought to have known better asked an electrical furnace operator in a Canadian plant just what burned inside and how the heat was generated. While his knowledge embraced a wide range of subjects, it did not extend to the subject of electro-metallurgy. His position in many respects corresponds to that of many plant engineers who have the purchase of equipment of this character in their hands.

In its essentials a comparatively simple mechanism, the proper design of both mechanical and electrical parts has a lot to do with successful operation.

The engineer, purchasing a furnace of any type, should carefully examine its design and the following sources of trouble may serve to indicate some of the weak spots.

The design of the doors is an important item. They should be so constructed as to present considerable resistance to the warping action of the hot interior of the furnace and the guides should be designed with this in view. Reasonable tightness is desirable and the more nearly gas tight the door is, the larger will be the life which may reasonably be expected.

The subject of counterweighting is one which should be carefully studied. Doors which require three or four men on the end of the counterweight lever to open them are worse than useless and money will have to be spent in the remodelling of the equipment.

Electric furnaces are built without exception with removable roofs or tops and the provision for changing roofs should receive attention. Not only should the roof be easily removable but the design should be such that the refractory brick can be laid up easily. It should also be borne in mind that the fewer the openings and the smaller their size —the longer the life which may be expected.

Electrode Gears

Electrode breakage is a very material item of expense in the operation of some furnaces and attention might well be paid to the design of the electrode gear for its minimization. In some designs a jib holding the electrode clamp projects from a structural steel mast and is arranged for vertical travel in this mast. The usual means of effecting this travel is to have wheels fastened to the jib and bearing on the inside of the flanges of the steel members of which the mast is made. It is obvious that the diameter of these wheels must be less than the width between flanges, but if there is much more than ¼ in. clearance trouble may be expected.

With the electrode hanging free in the furnace and not in contact with the charge the bottom guide wheels on the jib bear on the flange of the I-beam or channel furthest from the electrodes and the top ones bear on the near flange.

Should the electrode travel downwards until it is in contact with the charge, the position of these guide wheels is reversed owing to the release of the weight and the pressure upwards. This results in the turning of the electrode through a small vertical angle, depending on the wheel clearance and if the latter is of sufficient magnitude the electrode will likely bind on the charge and roof-ring of the furnace or may pinch in the electrode hole with resulting breakage. In one case, it was no uncommon occurrence to break several electrodes during the course of the day's run from this cause alone.

The jib is usually raised and lowered by means of a wire cable running over sheaves to an electrically operated winch. The method of attaching this cable is of some importance, for if it is simply passed through a punched hole in a plate cutting may be expected. Thimbles should always be used for the fastening of cables in this manner.

Mention has been made of the clearance of the jib guide wheels in the mast. Of almost equal importance is the clearance in a direction at right angles to the former. If this is not made of small amount, the electrode and its supporting mechanism will wobble sideways with harmful results.

The tilting gear is of much importance and it is essential that the motor be of a rugged type and its location well protected from splashings of hot metal and flying slag, to say nothing of the miscellaneous foundry dirt which is sure to find its way into the pit. The tilting motor control should be of an extremely rugged type and totally enclosed. All connections should be made in conduit.

A worm gear drive is usually incorporated into the tilting mechanism and it is of importance to notice that the worm gear should be of bronze. Cast iron is not a suitable material and is liable to cut. For the sector gears cast iron is suitable if the proportions are correct and allowance made for the heavy work which has to be performed. In some types of furnaces the sector gears take more than half the total weight of the furnace, and the importance of proper design can hardly be overestimated. Any failure of the tilting mechanism when pouring involves much inconvenience and at times considerable loss.

Direct current is usually used for operating the electrode and tilting motors when it is available and in this case dynamic breaking is usually resorted to. When alternating current is the only kind available, recourse must be had to solenoid-operated brakes for checking electrode travel and tilting. In this case, it is important to properly proportion the solenoid for proper current carrying capacity coils for heat dissipation. Burned-out coils are a source of annoyance and expense which can easily be obviated by proper design.

With automatic regulation it is important to see that a no-voltage attachment is provided. Without it, if the power supply is cut off through line failure the transformer switch opening, the regulator immediately starts the electrode travelling downwards with disastrous results to the electrode or its gear. With the no-voltage feature the regulator immediately ceases to function and the electrodes remain stationary unless hand control is used or until the power comes on again. It is important also to notice whether this no-voltage feature functions properly. If it does not, it is worse than useless since it only gives one a sense of security which is utterly false.

Ammeters are usually provided and in most cases they are installed in the regulator circuit. Care should be taken to see that they are of the proper scale to correspond to the current transformers. Thus, if the current transformers have a ratio of 4,000/5 amps., the ammeters should show a full scale deflection of 4,000 amperes when traversed by a current of 5 amps.

The ammeters should also be correctly installed in the secondary circuit of the transformers. This circuit is essentially of the series type, although modified by a parallel connection to the regulator rheostat. The ammeters should be installed in such a manner that all of the current generated by the secondary e.m.f. of the transformer passes through them and so that none of it is shunted by the rheostat above mentioned.

Low Tension Leads

Soldered connections should never be used on the low tension leads since any local heating is sure to melt the solder. Lugs should be cast on the leads or clamp connectors, if used, should be designed for ample current carrying capacity.

It is preferable to have an inverse time limit relay installed in connection with the transformer oil switch. This feature minimizes outage time particularly in the breaking down period.

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PRINCIPAL CONTENTS

Queer Ideas About Schools

THE chairman of the Toronto Board of Education is Dr. Noble. In his remarks at the first of the year on the occasion of the first meeting, he is reported to have said that he would not teach a child to read until a desire was created to get information from the printed page. Spelling he would teach hardly at all and geography only incidentally. "Why teach arithmetic in an age when we have adding machines?" he asks. Dr. Noble would have cafeterias, dancing, swimming tanks, etc., also movies.

Toronto is the reputed educational centre of Ontario. It is quite right that other places should look to this city for sane leadership in these matters.

It has not been claimed that Dr. Noble was misrepresented, and so it seems that his strange statements must stand.

"Why teach arithmetic in an age when we have adding machines?"

There would be equal sense in crying out: "Why teach or allow children to walk when we have automobiles?"

The adding machine is representative of fine mechanical work. It is a triumph to the brains of skilled inventors, designers and mechanics. Had Dr. Noble's childlike philosophy been in vogue, there would be no adding machines, there would be no gramophones that he urges for the schools.

Ask the mechanic who takes his trade seriously if he regrets having learned arithmetic. He will tell you that his regret was not that he learned it, but that he did not learn more of it.

Then there is that strange idea of not teaching the child to read until a desire had been created to get information from the printed page. Follow that to its logical conclusion and we have this: If the child has no desire to secure this information, let him slide. The sliders would be more numerous than those who had been roused by "the desire to obtain knowledge from the printed page."

The school system of this country should, more and more, bend to the practical. There are enough frills hitched on it now.

As far as this paper is concerned, we would much rather take the word of a man like Robert Patterson, of Stratford, who for 20 years was Master Mechanic of the Grand Trunk shops at Stratford, and an outstanding success in the matter of training apprentices. Would he urge less attention to mathematics in the schools? Not much. He would urge more attention. Would he pile on frills at the expense of essentials? He would not.

Only a few weeks ago CANADIAN MACHINERY discussed these matters at considerable length with Mr. Patterson. His criticism of our education plan is not destructive, like Dr. Noble's. His ideas are constructive. He favors teaching boys in the shops, and teaching them the subjects they must excel in in order to be leaders in their trades. He realizes that the tendency of the age will, of itself, keep boys from taking work or education too seriously. He has seen too many boys, from a lack of education, from habits of drift formed in their plastic years, shuffle off into the world with nothing to sell but their brute force to do hard, manual labor.

It is too bad that Dr. Noble had not taken the trouble to consult the industrial leaders before letting fly his half-baked ideas about freak schools.

New Cause For a Strike

THE president of the One Big Union in Fernie, B.C., is William Potter. He got on the train that runs up to the mines at Coal Creek, but would not pay his fare. He was ordered off, and as a result the miners refused to go to work.

Coal Creek, by the way, is the place where the Crow's Nest Pass Coal & Coke Co. operate. It is five miles from Fernie, but nearly all the miners live at Fernie, for the very good reason that the mountains have not left enough room for them to live at Coal Creek.

In one way we're inclined to agree with Bill. Perhaps he reckoned his ride up on the mine train was not worth paying for. That has always been an open question. The best commentary on the train is that in fine weather most of the men prefer to sit around the edge of flat cars.

But Bill getting put off the train was enough to keep the morning shift out of the mines. It was, in fact, an enormous offence. The idea of the president of the One Big Union being forced to leg it up to the mines is sad. Going up to the Creek is a stiff grade—it goes up some 500 feet in five miles. Had he been kicked off on the down trip our sympathy would not be disturbed. None of it would be carried off and handed out to One Big Bill.

For years past One Big Unionists and Socialists have been telling the miners and others that some day they would own the mines and everything else. That seed probably got in behind Bill's ear and sprouted. Who knows but on that day he imagined that he had a real honest-to-goodness claim on the mine train? Small wonder that William, as he gazed upon the conductor, recognized in him one of his hired men, and felt quite within his right in telling him to be gone when he asked that Bill should decorate the incoming side of the company's books with his fare that day.

The labor market of British Columbia must be in queer shape when the mines at a camp the size of Coal Creek deem the chucking of Bill from the train for not paying his fare to be sufficient cause for shutting down the mines for the day shift.

Publicity For Canada

THERE has been a great deal of advertising of one kind and another done for Canada, some of which, like the ice palace in Montreal, might have been well dispensed with. The Canadian Pacific Railway has been doing some real constructive advertising in Great Britain lately, which cannot fail to be of value to the Dominion. This has taken the form of illustrated lectures, the illustrations being carried out by a moving picture machine, showing the industries of the country in active operation. The first lecture was given in the Central Hall, Westminster, and the industrial views were preceded by a series of scenic subjects, which practically covered the Dominion. Then a film was shown which covered the paper-making industry, from the cutting of the tree, through the logging road, the drive to the mill boom, the sawing, barking, chipping, cooking, and so on to the finished product. The interest manifested by the audience was intense. Following this came a review of the wool industry, likewise traced from the back of the sheep to the finished cloth. Then came the asbestos mines of Quebec, and it was once more demonstrated that the bulk of the world's asbestos supply was concentrated in that Province. The explanatory lecture was introduced by a speech from Sir George McLaren Brown, European manager of the Canadian Pacific Railway, who emphasized the necessity of cementing the component parts of the Empire together in such a manner that disruption would be impossible. Educative propaganda of this kind is of the utmost benefit to Canada, and should have the effect of inducing the very best kind of immigration. We must have immigration if the great resources of this country are to be developed as they should, and scenes from the actual life of the country are a much better means of persuading the intending settler than the doubtful methods employed in the East by unscrupulous immigration agents.

Building up the Liner Fleet

REPORTS from England tell of the launching of two purely passenger liners, one for the fleet of the Pacific Steam Navigation Company, and one for the Anchor Line. These vessels are noteworthy for the fact that they are the first vessels built since the war of the purely liner type. By this it is not meant to convey that they are of the New York route class, but they are designed as liners, and not cargo boats. They also tend to illustrate the lines upon which the replenishing of the passenger fleets of Great Britain will be carried out. The luxurious fast passenger vessel of the "Lusitania" and "Aquitania" class will not be built in the immediate future. The need is for the intermediate type of passenger boat, with a moderate speed of 17 to 18 knots, having ample passenger accommodation, coupled with a relatively large carrying capacity. They will be economical of fuel, and in many cases, in fact, the majority, will be fitted to burn oil fuel. The propelling machinery will be geared turbines. Many of the existing ships of the large passenger lines are being converted from coal burners to oil burners, the greatest of all being the "Aquitania," which is being altered and reconditioned at the yards of Armstrong, Whitworth on the Tyne. The Cunard, Anchor, Anchor-Donaldson, and Anchor-Brocklebank lines are building between them 34 ships, aggregating about 400,000 tons, every one of which will be oil burning, and geared turbine driven. While standardization, as it was understood during the war, cannot be applied to these specially-designed ships, shipowners will build numbers of vessels to the same design, thus allowing them to order all the material for a series of ships well in advance, to the same specifications. The building of the liner fleet, which is so much needed to maintain Britain in the forefront of the maritime world, will proceed from now on with speed and regularity, till she is once more in the forefront, where she can be trusted to remain.

Inaccuracy in Reports

WHILE the average technical article is reliable, and great care is taken to make it so both by the author and the editorial staff of the paper in which it appears, still occasionally someone slips up and an error or false statement palpably inaccurate creeps in. We are referring to a recently-published statement in connection with radiation loss. The point at issue is in the figure of 502° appearing on a chart as the temperature of the exterior wall of the setting. This is pretty warm.

An Iowa inventor has obtained a patent upon a unicycle that is driven by an electric motor and prevented from falling by gyroscopic fly wheels.

On the principle of spring window shades, but operated horizontally, an index that can be attached to desk telephones has been invented.

An international exhibition for the reconstruction of the industrial, agricultural and commercial life of France will be held at Lille from May until October, 1920.

Flames from an oil or gas stove do not come in contact with the food cooked on a new broiler, which consists of hollow tubes, through which pass heated gases generated in a combustion.

A subterranean river in the Philippines is navigable by small boats for two and a half miles from its mouth, passing through several large stalactite hung caverns.

A partitioned metal tray has been invented that telescopes to fit a desk drawer of any size.

An inventor has equipped the back of a small brush with rubber suction cups to hold it on a wash bowl or other smooth surface for the convenience of one-armed persons.

Chiefly for photographing machinery, a camera has been invented large enough for a man to enter it to change the plates.

To make a motorboat of any craft, an inventor has mounted an engine, shaft and propeller in a hollow fin which he used to replace the boat's keel.

An automobile speedometer has been invented that can be set to regulate the speed of a car and prevent it being

ABOUT TIME.

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—Coffman for the International Feature Service.

MARKET DEVELOPMENTS

High Prices and Shortage Still Here

Little Material in Warehouses—Pipe Prices Advance—Production in the Steel Mills is Still Behind—Future Chances of Catching Up Are Not Certain

IN practically all branches of the steel trade a shortage is noticed. There is the same story of depleted stocks from warehouses, and production in the mills nowhere near catching up with the demand. Under these circumstances, there is no difficulty in getting premiums, and sheet mills that have been getting $10 for first quarter, have placed business for second quarter at the same rates. Whether the scarcity will continue into the future or not is a question on which the experts differ. Some think it is a temporary effect caused by the strike, and other adverse factors, and that the mills will catch up when given a reasonable time. Others incline to the opinion that there will be heavy buying by the railways in the near future that will effectually preclude the chances of replenishing stock. The coke situation is improving, but not rapidly enough to suit all parties concerned.

In Toronto there has not been so much activity this past week. Climatic conditions may have something to do with this, and it is expected that a revival will take place with the coming of spring. There has been a good business in small tools, and a large enquiry is out for the Canadian National Railways. Warehouses here are just as short as any other centre.

There has been some good buying in the New York market, in machine tools, a good percentage of which was for woodworking machinery for shipyard use.

MONTREAL STILL SHORT OF BLACK AND GALVANIZED SHEETS

Special to CANADIAN MACHINERY.

IT is reported by local steel dealers that the demand during the past week has declined slightly, but the volume of business is comparatively fair in view of present conditions. The prospect for greater production is looked for in some quarters as a result of the recent calling off of the steel strike, but it is the opinion of some of the dealers that this development will have little material effect upon the operation of the mills, as the situation has gradually adjusted itself until at the present time there are few men still out. It is believed that the early return of the American railroads to the former owners will be the signal for the placement of large orders for railway equipment, and the heavy inquiry for plates is some indication of early future developments. The tube situation maintains its strong position, with supplies hard to obtain. Current prices, in general, show an advance over those of last week, although some prices are never lower. On some of the smaller sizes of seamless the prices are a little easier, but tend upward on the larger tubes. Four-inch is now $85 per hundred feet, an advance of $10 per hundred. Lapweld prices show an approximate advance of 5 per cent. over those last quoted; 1½-inch are now $28, and four-inch are $58.75.

The feature of the week is still the marked scarcity of all classes of sheets, both black and galvanized; it is almost impossible to obtain any of the former and the inability to obtain these keeps the galvanizers from operating at capacity. Warehouses are completely stripped of the majority of sizes in black and galvanized sheets. The prices quoted are those accepted for delivery at convenience. Urgent requirements for 2 to 3 months' shipment are sometimes made at premium prices, but definite data in this regard is difficult to secure. The early spring demand may occasion a much stronger market with a corresponding advance in prices.

Strength Still a Feature

A strong market still prevails in non-ferrous metals, and a fair demand marks the week's activities. Copper has fluctuated a little and the current quotation shows a higher price than last quoted. Lake is 25½ cents and electro 24½ cents, an advance in each case of ½ cent per lb. The strength of the English tin market has been reflected here and a nominal price of 72 cents is the base of dealer's quotations. Lead is stronger on good demand, the price of 10¼ cents representing an advance of ¾ cent per lb. Antimony is also ½ cent higher at 12 cents per lb.

Manufacturers Meet Exchange

The delivery on new equipment continues to be the feature of machine tool activity, as shipment of tools coming in from the States cannot be guaranteed for many months. The average period is from six to eight months, and in some instances 1921 has been specified. The rate of exchange now effective is causing some anxiety on the part of both manufacturer and purchaser, and this factor of present business has a tendency to place considerable more business in the hands of Canadian firms than would otherwise be the case. Some American firms are taking this situation into account and dealers here report that U. S. manufacturers are willing to meet prospective buyers on the question of exchange and allow for same if necessary.

Apart from the high exchange rate the tendency is for higher prices on many tools. The week's transactions denote a quieter inquiry for new machines. The demand is widespread and general in character. Considerable business is still done in rebuilt machine tools.

Machinery Scrap Still Leads

With the possible exception of machinery scrap, which is still to the fore as regards demand, the general situation is comparatively quiet and dealers report few developments of an interesting character. There appears to be a revival in the inquiry as to steel and iron scraps, but little to indicate that buying in the near future will be out of the ordinary. Dealers here state that the market is quite firm, particularly in irons, but some lines of non-ferrous scraps are weakening. Prices, however, are unchanged, but should be considered as nominal.

IS STEEL SHORTAGE OVERRATED NOW?

Some Think So, But Fact Remains That Warehouses and Stock Racks Are Empty

TORONTO.—Business has not been particularly brisk during the week in the Toronto field. It may be that the weather has had the tendency to keep people away from here. Inquiries have been fair, though, and it is fully anticipated that the coming of spring, with its attendant expansion, will see a revival of business in all lines of machinery, small tools, steel, iron, etc.

One of the big questions is that of catching up with the orders that are already on the books of machinery and steel houses. There is a feeling, expressed quite often, that the shortage of steel is being exaggerated in some cases, not so much as affecting the present figures, but in regard to the ability of the steel mills to bring up their production figures to something sufficient to give consumers all the steel they want in reasonable delivery time.

Against all this sort of talk is the fact that there is a shortage in the warehouses. There is a shortage in the stock racks of the consumers. This does not apply only to Canadian, but to American conditions as well. One of the warehouse men who has returned from the States reports that affairs are even worse there than they are in Canada.

"I went to Cleveland, Chicago, Pittsburgh, and other of the best warehousing centres. I wanted to see what the condition was there, and if we were any worse off than those in the same business across the line. There does not seem to have been the same rush of business here as there, for the warehouses in United States are cleaned out entirely in many of the much wanted lines. They are, for the most part, staying with the price schedule that was announced on March 21, but they have nothing to deliver, so what difference does their price list make? The scalpers and the adventurers have been having a good innings lately," he continued. "I believe they can get about any price that comes into their head to ask for. As far as I could see, they were not looking for any immediate relief to the situation, as the mill deliveries are not improving to any extent.

"For instance, it is almost correct to say that you cannot buy tubes now. The warehouses where I visited couldn't sell them because they didn't have them, and saw no chance of replenishing their stocks. Here is something that will show the way some of the prices are going in the States: A firm in Cleveland got a line on 500 tons of blue annealed sheets. Now, remember that the March 21 price was 3.55 base for these, and then put it down that the price asked for this 500-ton lot was 6.50."

This line of material is used largely for tank work, smoke stacks, etc.

There is still some difficulty in securing shipments of British-made goods for this market, but, according to several of those who are following the situation closely, there will be an improvement in the not far distant future.

Progress is being made in putting the war material on the market here, but much of it is scattered in several shops, and it makes it very hard for those in charge to get out definite lists to send to the trade. There was a quick clean-up of desks, chairs, typewriters, and other lines of office furniture that the Ordnance Department had to offer, and practically all that material has gone.

The Machine Tool Market

The buying of equipment for the St. Malo shops of the National Railways has been one of the largest lists sent out to the trade this year. There are some 13 tools in all, and tenders have been sent in by several of the dealers in this district. There is some little criticism regarding the way the Government buys. Dealers claim there is such a long time between the date the tender is put in and the time the business is placed. In that period there is apt to be several changes in prices.

One firm making several lines of grinders announce a five per cent. increase at once.

Dealers handling small tools report a good business. In fact one of these dealers stated that he had done as much business in a week in January than he had turned over in the whole month last year. Deliveries are none too good on some lines of cutters.

POINTS IN WEEK'S MARKETING NOTES

Sheet mills find no trouble in securing a $10 premium.

Foundry pig iron is selling for last half of 1920 at $39, Buffalo.

The belief that railroads would be very much in the market for steel seems to be doubted in some quarters, as the roads will have financial troubles to attend to them.

Most of the large jobbers in United States are selling on the March 21 list, but they have a scanty assortment for sale. The scalpers and adventurers are making merry, though, over all material that comes their way.

Some of the independent pipe mills announce an advance of $10 or $11 a ton on oil country goods.

One maker of grinders announces a five per cent. increase, effective at once. They are paying more for their castings, and other charges have also increased.

An effort is to be made to keep bar prices in Toronto at 4.75, rather tha allow a higher figure.

The National Railways are getting tenders on a list of a dozen or so large tools for the St. Malo shops.

NEW YORK HAS A QUIETER MARKET

THERE ARE SEVERAL FIRMS THAT ARE DOING BUYING ON A FAIRLY LARGE SCALE

Special to CANADIAN MACHINERY.

NEW YORK, Jan. 22.—The largest buying of the past week has been done by the Newport News Shipbuilding & Dry Dock Co., Newport News, Va., whose purchasing department is in the Woolworth Building, New York. The total requirements of the shipbuilding companies is about 250 machines, of which a considerable part is woodworking machinery. Some of the orders were tentatively placed before the close of the year, but confirming orders are just being given.

The Savage Arms Corporation, Utica, N. Y., is inquiring for machine-tool equipment for the manufacture of ball bearings. The Otis Elevator Co., New York, is doing a little buying to round out its recent purchases. Westinghouse, Church, Kerr & Co., New York, are buying the equipment for the extensions of the American Rolling Mills Co., Middletown, O., which will probably include some machine tools.

The General Electric Co., Schenectady, N. Y.. continues to buy for its Rochester, N. Y., plant, and has issued new lists totalling about thirty machines.

Otherwise the market is somewhat quieter than it has been for several weeks.

ANNOUNCEMENT

General Forgings and Stampings, Ltd., is the new name of the Canada Pole and Shaft Company, Ltd.. Merritton. This change of name has been found advisable owing to the fact that the business has been gradually changing from that of a pole and shaft and woodworking business to that of a forging and stamping business. For a considerable period the company has been operating only on automobile forgings and stampings. This line will be followed exclusively from now on.

IS FUTURE TOO MUCH DISCOUNTED ON THE SHORTAGE IN STEEL MARKET?

Special to CANADIAN MACHINERY.

PITTSBURGH, Jan. 21.—The pig iron and steel markets present certain appearances of growing stronger. Sheet mills that had been obtaining $10 a ton premium, or thereabouts, on first quarter contracts have lately been able to place some contracts for second quarter at the same prices. Some foundry pig iron has gone for the second half of the year at $38 to $39, both f.o.b. valley furnaces and f.o.b. Buffalo furnaces. These, and a few similar items, would suggest that the period of scarcity, which has produced such high prices of late, is expected to be prolonged.

It is too soon, however, to draw general conclusions. Fundamental conditions, particularly financial conditions, are very far from satisfactory, according to the views of nearly all bankers. Then there is the fact that anyone can ascertain by just a little investigation, that the steel market has been relying on some favorable factors that do not really exist. There is, for instance, the expectation, generally entertained, that the railroad companies will be larger buyers immediately, or soon after the lines are returned to their owners March 1. If that were the case, as it seems to be generally assumed in the steel trade it is, railroad men themselves would, presumably, know something about it; but it is quite plain that what railroad men have on their minds at present is the group of serious financial problems they have, to finance the debts they will owe the Government for improvements made during the control period, making it that the lines will be returned to their owners in better condition than when received, and to finance various obligations to mature in the near future. In other words, the steel market appears to have discounted a favorable development that is not going to occur.

Another reason that makes it unsafe to assume that scarcity of pig iron and steel will continue indefinitely is that not enough time has elapsed to test the effect upon the situation as to supply and demand of increasing production. Just now the consuming industries are feeling keenly the effect of the curtailment in production due to the iron and steel strike. While the strike, as a strike, was almost over by December 1, the scarcity of fuel produced by the coal strike, and the car shortage that developed promptly upon the resumption of mining, have operated to retard greatly the resumption of full activity by the iron and steel industry. Even at this date, the production of steel has scarcely returned to the rate obtaining in September, just before the strike started, that rate having been in the neighborhood of 83 per cent. of capacity. When pig iron and steel production rise to 95 or 100 per cent. of capacity, the situation will, presumably, be altered. It is true there are some in the producing ranks who speak as if there is little hope of the industry operating efficiently, and they may be right; but it certainly would be a curious situation for the merchant blast furnaces and the steel mills to be unable to operate satisfactorily, but for the customers of these producers to be able to operate well and to be prepared to take maximum tonnages of their pig iron and steel materials.

Coke Supplies

Production of coke has been increasing steadily at the by-product ovens since the middle of December, when coal was released, as a result of the mining settlement; but the increase has been slow, and much slower than desired. Production in the Connellsville region suffered a back-set at holiday time, while since then it has been at the same rate as obtained the week before Christmas. The Connellsville coke operators have been complaining loudly of car shortage; but it must be remembered that the shortage is in relation to the increased production they desire and their customers desire. In the past three weeks they have been getting as many cars as they were getting before Christmas. The coke supply prevents a number of idle blast furnaces from blowing in, and a few furnaces actually in blast have had to run at less than capacity because of not receiving full supplies of coke. In active times industrially, a shortage of coke at this time of year is the rule rather than the exception, and the shortage is generally relieved before the end of January. In this instance, the shortage may last longer; but even at that, the balance of probability is that there will be an ample supply by the time the worst of the winter weather is over. Present prices, under Government control, $6 for furnace and $7 for foundry, per net ton at ovens, Connellsville region, are very profitable to the producers; but when Government control is removed, the furnaces will be quite willing to pay still higher prices, if they are needed to stimulate production.

Pipe Advance

Several of the independent pipe mills have advanced oil country goods for $10 or $11 a ton, and they can readily obtain the advanced prices for such deliveries as they can make in the next few months, since the producers holding to the old prices are filled with business for a long time to come. Advances in standard steel pipe are also being made. While it is stated there is no concerted action, it is very probable that all but one or two of the independent pipe mills will advance their prices three and a half points, or about $7 a ton, thus putting their card on a 54 per cent. basing discount that ruled from December 12, 1918, to March 21, 1919, when the 57½ per cent. basing discount was adopted, at the time of the Industrial Board's efforts to stabilize prices generally.

Pig Iron

The foundry iron furnaces are sold up tight for several months, and orders for prompt lots can be placed only at premiums, $40 valley being a relatively low price for single carloads of No. 2, while for extended delivery, say late in the second quarter or for second half, the market is firm at $38, valley. A carload of high silicon iron, 3.00 to 3.25 per cent. silicon, has just sold at $46, valley. Bessemer and basic, on moderate sales, are up $2 a ton, to $37, valley, for basic and $38, valley, for Bessemer; but these grades are cheap relative to foundry iron.

There is better news in the nail trade. For some reason or other, the steel strike affected the wire mills, as a whole, more than other branches of the steel industry, and the nail-making departments were especially hard hit. When the strike was practically over elsewhere, nail production was still relatively light. In the past ten days, reports have been of employment being much better in nail departments, and of production increasing very decidedly. The market does not reflect, as yet, any loosening up in the supply, as independent mills are still able to get $4.25 to $4.50 for deliveries over a few weeks, against the American Steel & Wire Company's settling price with its regular trade, which has been $3.25 ever since last March. The great shortage in production is evidenced by the high prices obtained during a period when nails were really out of season.

VENEERING PRESSES

The West Tire Setter Co., Rochester, N.Y., are manufacturing a gluing press that is adaptable to the requirements of paper box and veneer factories, piano, furniture and other woodworking concerns. It is of the hydraulic type, equipped with a belt-driven pump, and is built in various sizes, according to specifications. One of the presses was recently installed by a concern manufacturing cedarized cigar boxes, in which the stock consists of paper veneer over a wood body.

The company reports good business from France in heavy motor car wheel-setting machines.

It is commonly supposed that the Thermos flask was invented in America or Germany. The real facts have been made known by the successful application by Sir James Dewar for an extension of his patent, No. 13,638 of 1904, for, inter alia, the application of a method of absorbing gases to the production of high vacua. In scientific books the Thermos is called the Dewar flask.—Engineering.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$33 00
Lake Superior, charcoal, Chicago	38 40
Standard low phos., Philadelphia	40 00-40 00
Bessemer, Pittsburgh	35 00
Basic, Valley furnace	30 00
Toronto price:—	
Silicon, 2.25% to 2.75%	47 30

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 4 75
Steel bars, base, Toronto	4 75
Steel bars, 2 in. to 4 in. base	6 00
Steel bars, 4 in. and larger base	6 50
Iron bars, base, Montreal	4 25
Steel bars, base, Montreal	4 25
Reinforcing bars, base	4 75
Steel hoops	6 00
Norway iron	11 00
Tire steel	5 50
Spring steel	8 00
Band steel, No. 10 gauge and 3-16 in. base	5 25
Chequered floor plate, 3-16 in.	7 50
Chequered floor plate, ¼ in.	7 00
Staybolt iron	8 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	2 35
Tank plates, Pittsburgh	2 65
Structural shapes, Pittsburgh	2 45
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 90
Small shapes under 3"	3 62

FREIGHT RATES

Pittsburgh to Following Points	Per 100 Pounds. C.L.	L.C.L.
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

		Gross.
Lake copper	$25 50	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	72 00	60 00
Spelter	11 50	10 75
Lead	10 25	8 75
Antimony	12 00	10 50
Aluminum	33 00	35 00

Prices per 100 lbs.

PLATES

	Montreal	Toronto
Plates, ¼ up	$ 5 00	$ 5 00
Plates, 3-16 in.	5 25	5 25

Price List No. 38

WROUGHT PIPES

Standard Buttweld		
⅛ in.	$ 6 00	$ 8 00
¼ in.	4 68	6 81
⅜ in.	4 68	6 81
½ in.	6 21	7 78
¾ in.	7 82	9 95
1 in.	11 56	14 71
1¼ in.	15 64	19 90
1½ in.	18 70	23 76
2 in.	25 16	32 01
2½ in.	40 37	51 19
3 in.	52 79	66 94
3½ in.	67 16	84 18
4 in.	79 57	99 74
Standard Lapweld		
2 in.	38 81	35 34
2½ in.	42 12	52 36
3 in.	55 08	68 47
3½ in.	69 00	86 94
4 in.	81 75	103 00
4½ in.	93	1 18
5 in.	1 08	1 37
6 in.	1 40	1 78
7 in.	1 83	2 32
8L in.	1 93	2 44
8 in.	2 22	2 81
9 in.	2 66	3 36
10L in.	2 46	3 12
10 in.	3 17	4 02

Terms 2% 30 days, approved credit.

Freight equalized on Chatham, Guelph, Hamilton, London, Montreal, Toronto, Welland.

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.
4½" and larger 50%.
4" and under, running thread, 30%.
Standard couplings, 4" and under, 40%,
4½" and larger, 20%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$14 00	13 75
Copper, crucible	17 00	17 00
Copper, heavy	17 00	17 00
Copper wire	17 00	17 00
No. 1 machine composition	15 25	16 00
New brass cuttings	11 00	10 75
Red brass cuttings	14 00	14 75
Yellow brass turnings	8 00	9 00
Light brass	6 25	7 00
Medium brass	7 25	7 75
Scrap zinc	6 00	6 00
Heavy lead	5 00	6 00
Tea lead	3 75	3 50
Aluminum	18 00	18 00
	Per Ton	Gross
Heavy melting steel	15 00	16 00
Boiler plate	15 00	11 00
Axles (wrought iron)	25 00	20 00
Rails (scrap)	16 00	16 00
Malleable scrap	25 00	20 00
No. 1 machine cast iron	24 00	25 00
Pipe, wrought	10 00	9 00
Car wheels	22 00	20 00
Steel Axles	21 00	20 00
Mach. shop turnings	9 00	11 00
Stove plate	22 00	21 00
Cast boring	10 00	11 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜" and less	15
Carriage bolts, 7-16 and up	Net
Coach and lag screws	30
Stove bolts	50
Wrought washers	50
Elevator bolts	5
Machine bolts, 7-16 and over	10
Machine bolts, ⅜" and less	20
Blank bolts	25
Bolt ends	10
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square blank	add $1.50
Nuts, square, tapped	add 1 75
Nuts, hex., blank	add 1 75
Nuts, hex., tapped	add 2 00
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent.
Set screws	40
Sq. and Hex. Head Cap Screws	35
Rd. and Fil. Head Cap Screws	5
Flat But. Hd. Cap Screws	10
Fin. and Semi-fin. nuts up to 1 in.	35
Fin. and Semi-fin. nuts, over 1 in., up to 1½ in.	25
Fin. and Semi-fin. nuts over 1½ in., up to 2 in.	10
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws ... list plus 20,	30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$43 00
Open-hearth billets	43 00
O.H. sheet bars	46 00
Forging billets	56 00
Wire rods	55 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$4 95
Cut nails	5 00
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 32
British Manila rope	0 26
New Zealand hemp	0 26
Transmission rope, Manila	0 43
Cotton rope, ¼-in. and up	0 80

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net

MISCELLANEOUS

Solder, strictly	$ 0 34
Solder, guaranteed	0 39
Babbitt metals	18 to 70
Soldering coppers, lb.	0 58
Lead wool, per lb.	0 14
Putty, 100-lb. drums	6 75
White lead, pure, cwt.	17 80
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English	0 35
Tarred slater's paper, roll	1 30
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls., gal.	1 50
Linseed oil, raw, single bbls.	2 90
Linseed oil, boiled, single bbls.	2 92
Plaster Paris, per bbl.	4 50
Sandpaper, B. & A.	List plus 43
Emery cloth	List plus 37½
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 07
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 50

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes up to 52	40
S.S. drills, wire sizes, No. 53 to 80	40-10-5
Standard drills, all sizes	40-10-5
3-fluted drills, plus	10
Jobbers' and letter sizes	40-10-5
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	net
Drills and countersinks	5% off
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus 20 to	40
Canadian high speed cutters, net to	10 off
American	plus 40

COLD ROLLED SHAFTING

At mill	list plus 5%
At warehouse	list plus 25%

Discounts off new list. Warehouse price at Montreal and Toronto

IRON PIPE FITTINGS

Malleable fittings, class A, 20% on list; class B and C, net list. Cast iron fittings, 15% off list. Malleable bushings, 25 and 7½%; cast bushings, 25%; unions, 45%; plugs, 20% off list. Net prices malleable fittings; class B black, 24½c lb.; class C black, 15¾c lb.; galvanized, class B, 34c lb.; class C, 24½c lb. F.O.B. Toronto.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 7 00	$ 6 75
Sheets, black, No. 10	6 50	6 50
Canada plates, dull, 52 sheets	8 50	8 00
Can. plates, all bright	8 50	9 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	....	....
Fleur-de-Lis, 28 B.W.G.	....	....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28	....	....
Premier, No. 28, U.S.	....	9 25
Premier, 10¾ oz.	....	9 65
Zinc sheets	20 00	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅞ in., $9.20; ¾ in., $9.30; ⅝ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	28 00
1¾ in.	31 50	28 50
2 in.	30 00	26 75
2¼ in.	35 00	29 00
2½ in.	42 00	53 00
3 in.	50 00	42 00
3¼ in.	.....	46 00
3½ in.	63 00	49 00
4 in.	85 00	58 75

Above prices advanced 5%.

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	24½
Palacine	27½
Machine oil, per gal.	40
Black oil, per gal.	15
Cylinder oil, Capital	58
Cylinder oil, Acme	45
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	$2 60
Union thread cutting oil, antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil, bbls. net	8

BELTING—No 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30, 10%
Cut leather lacing, No. 1	2 20
Leather in sides	1 75

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 60
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	09
Pumice, ground	06
Emery glue	30
Tripoli composition	09
Crocus composition	12
Emery composition	10
Rouge, silver	60
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE

XXX Extra	19½	Atlas	17
Peerless	19	X Empire	15½
Grand	18	Ideal	16
Superior	18	X Press	14
X L C R	17		

Colored

Lion	15	Popular	12
Standard	13½	Keen	10½
No. 1	13½		

Wool Packing

Arrow	25	Anvil	15
Axle	20	Anchor	11

Washed Wipers

Select White	.11	Dark colored	.09
Mixed colored	.10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades... 15%

ANODES

Nickel	.58 to .65
Copper	.38 to .45
Tin	.70 to .70
Zinc	.18 to .18

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6 x 4 base	45 00	44 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 75	$11 50
Sheets, 3½ lbs. sq. ft.	10 50	11 00
Sheets, 4 to 6 lbs. sq. ft.	10 25	10 50

Cut sheets, ½c per lb. extra.

Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .23
Acid, hydrochloric	.03¼
Acid, nitric	.10
Acid, sulphuric	.03¼
Ammonia, aqua	.15
Ammonium, carbonate	.20
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, annhy	.41
Copper, sulphate	.16
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.08
Nickel carbonate	.32
Nickel sulphate	.19
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.25
Silver nitrate (per oz.)	1.20
Sodium bisulphate	.11
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.18
Tin chloride	1.00
Zinc chloride, C.P.	.30
Xinc sulphate	.08

Prices per lb. unless otherwise stated

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CANADIAN MACHINERY AND MANUFACTURING NEWS

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Interchangeability as an aid to Greater Production

The Need of Accurate Production in Any Line of Industry is Too Well Known to Require Comment. Herein Are Shown and Described Various Precision Tools Used to Obtain Such Results.

By J. H. MOORE

THERE was a period when the term production did not mean so much in the mechanical world as it implies to-day. Manufacturers had very little competition to deal with, never stretching themselves to produce an article in the shortest time possible, nor attempting to secure interchangeability. In fact the latter-mentioned word had an ugly sound to them, forecasting all sorts of difficulties and pitfalls.

Take for example the case of many makes of the earlier models of the Linotype. The feature of interchangeability was largely conspicuous by its absence in this case, and considerable trouble and irritation resulted from this fact.

A machine of such nature, consisting as it does of some 3,600 odd parts, is bound to get out of order to some extent. A break occurs and a new piece is required at once. Providing that all parts are interchangeable, the problem is a small one, but in those old days, when very few parts were a duplicate of each other, the fun (?) encountered was sometimes great. It was necessary to file this, grind that, and so on.

It was only natural that such a condition had to change, and change it did, for to-day this type of machine, of which there are numerous makes, is so improved, that all parts are absolutely interchangeable. In the event of a breakdown out comes the broken portion and in goes a new piece, a perfect fit, without any trouble.

How has such a sweeping change become possible? Simply through forethought, together with careful planning of jigs and fixtures, test gauges, etc. All this did not happen in a day, but has been the result of steady improvement as time went on. What holds good in the story of the Linotype, likewise applies to the use of production and inspection tools in the machine tool industry.

The writer can well remember the time when jigs and fixtures were looked upon as, well, a sort of wild dream on the part of an efficiency expert, and as for the fellow who carried a first-class set of tools in his kit, why, he was considered crazy. The idea of spending his own money to produce better work for the company was always a subject for a joke.

To-day the opposite condition holds good, for the chap who works with old-fashioned tools is out of date, a back number, and not to be classed with the other type of workman who delights in keeping his tool kit up to the minute.

From this statement it is not to be inferred that good tools make good workmen. Far from it, for we have seen a mighty poor workman handling good tools. We have also seen cases of a good workman using poor tools, with poor results, who could have obtained the best of results with the proper equipment, but in the latter case the workman soon got wise to himself.

All these facts, however, are already history, so why repeat them? Let us proceed into a talk on production and inspection of tools, taking it for granted that all readers agree with us as to the feasibility and advantage of their use.

To confine oneself to any particular branch of industry would be impossible, but of one thing we can speak, and that is the fact that the real problem in any manufacturing process is the designing and building of special tools, jigs, fixtures and gauges necessary for the economical production of the product no matter what it may be, making sure that all parts are interchangeable.

Of course we are taking it for granted that the product is to be turned out in reasonable quantities, for the fact of quantity enters largely into the problem of how much should be expended on fixtures, gauges, etc. A concern like the Ford Motor Car Co. can afford (no pun

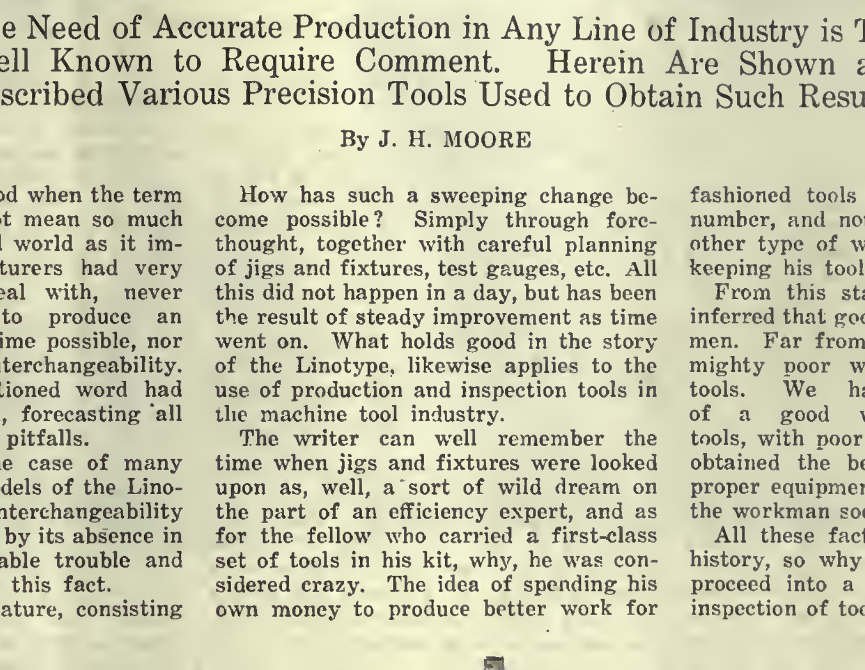


FIG. 1—ILLUSTRATING THE USEFULNESS OF THE ADJUSTABLE KNEE IN SETTING UP TO CHECK MEASUREMENTS.

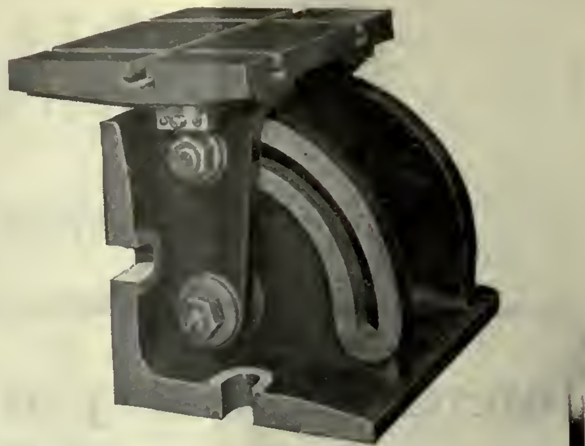



FIG. 2—TWO VIEWS OF A TOOLMAKER'S ADJUSTABLE KNEE.

intended) to spend considerable money on a special speeding-up fixture, for their production is so great, while a manufacturer turning out say only 5,000 machines a year could not attempt to equip his plant in a manner similar to the first-mentioned concern. In other words the planning of equipment expense is largely dependent on the quantity produced.

Usually the first germ of the idea is created in the drawing office. This is especially true in the case of a jig or fixture. The idea is thrashed out thoroughly, until it is at last O.K.'d, traced, blueprinted, and passed on to the tool room.

The Need of Good Tools

We will suppose the fixture designed is to be used on the lathe, the operation being the turning of the taper portion on an automobile brake rod support. The taper on such a piece is about 3 inches long, and all pieces must be exact duplicates of each other.

In order to make sure that all dimensions on the turning fixture are accurate, the toolmaker should be equipped with only the best of precision tools. Take for example Fig. 1. While this illustration does not depict a fixture of the nature we speak of, it does show clearly a good example where the adjustable knee, or swivel angle block (as it is sometimes called) can be used to advantage.

By the use of this production tool you can clamp a fixture securely, marking such measurements as you see fit, or checking dimensions, as the case may be, feeling assured that the results obtained will be accurate in every respect, providing of course you exercise reasonable care and use a good grade of measuring tool.

Fig. 2 gives two different views of this style of adjustable knee under discussion. As can be noted, it can be set to any desired angle. Sine buttons with sufficient centre distance for obtaining angles accurately, are set in one end of the knee. At the other end is a graduated section and vernier, reading to 5 minutes, which enables the knee to be set quickly to within 5 minutes of the required angle.

The working faces of the knee are provided with T slots for bolting the work to the tilting table.

Usually the height of this type of knee is 9 inches when in horizontal position, which is ample height to allow the handling of quite a variety of work. Wherever accurate tool or fixture work is being performed, a knee of this nature not only speeds up the work but helps to ensure its being correct.

The Testing of the Taper

Let us suppose the piece already mentioned is completed, all but the inspection test. In order to test the accuracy of the taper we must first have a suitable gauge for the purpose.

At Fig. 3 is illustrated a gauge of such a nature, while at Fig. 4 is shown the tool in actual use.

Such a gauge as illustrated is well adapted for use in connection with the economical reproduction of any taper within its limits. It is made up of two adjustable straight edges mounted on a cast iron body, with a convenient handle on one side by which the gauge may be held or clamped when in use. Of course, as can be understood, various sizes of this tool are made, the sizes of the test blades varying in length.

The Measuring of Angles

In the making of taper test plugs and other work of like nature it is essential that the toolmaker have some means of accurately testing his angles. For this purpose a sine bar fixture as shown in Fig. 5 is often used. Any part can be accurately laid out, made and inspected with the aid of this type of fixture. Pieces with several measurements can often be checked with one set up on the sine bar. Standard or special tapers can be accurately made, both cylindrical and flat. The bar illustrated is what is known as the improved type, and has a clamping device by which the pivot stud can be clamped at any height, independent of the clamping arrangement of the bar. Such an advantage is no doubt obvious to every reader so we make no further comment on this feature.

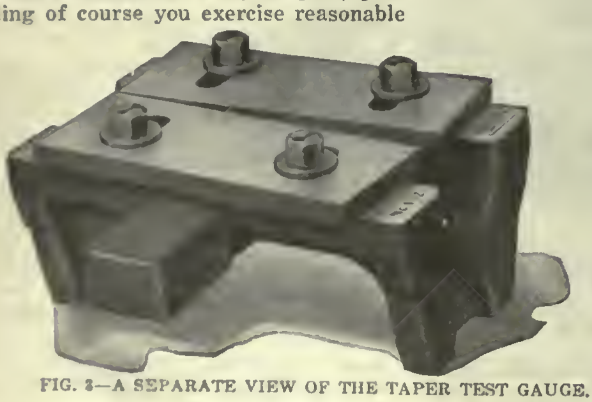


FIG. 3—A SEPARATE VIEW OF THE TAPER TEST GAUGE.

FIG. 4—IN THE ILLUSTRATION SHOWN THE GAUGE IS BEING USED FOR DUPLICATING TAPER SHANKS ON CUTTER BLANKS.

FIG. 5—A SEPARATE VIEW OF THE SINE BAR FIXTURE.

FIG. 6—USING THE SINE BAR FIXTURE FOR TWO DIFFERENT STYLES OF WORK.

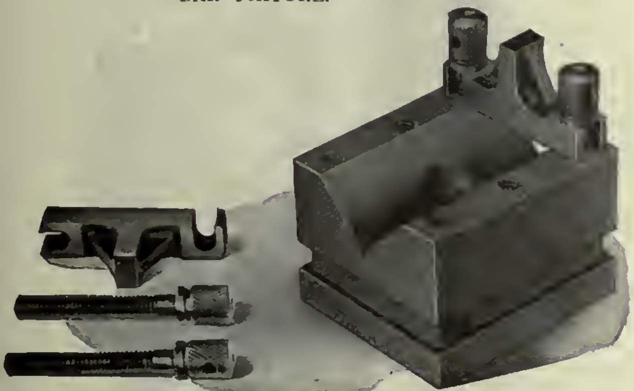


FIG. 7—ONE STYLE OF "V" BLOCK OFTEN USED.

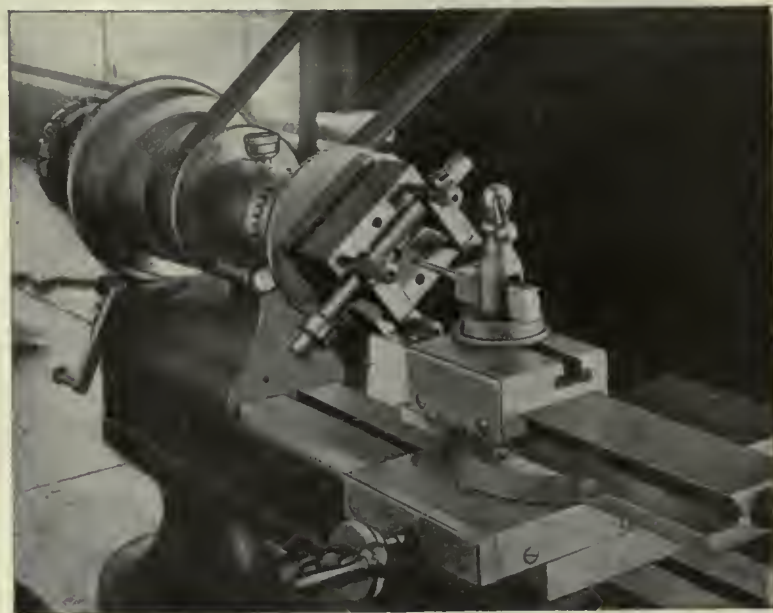


FIG. 8—USING THE "V" BLOCK AS A MEANS OF BORING A HOLE ACCURATELY THROUGH A STUD.

To illustrate how such a bar is used, let us refer to Fig. 6. Here we see two different set-ups and steps in the measurement of a taper test plug. The illustrations are so clear in themselves that it is hardly necessary for us to go into details.

The Use of the V-Block

The V-block and its uses are not as familiar to the average mechanic or toolmaker as they should be. Of course there are innumerable styles of blocks, from the common garden variety to the finer finished article.

As readers are no doubt familiar with the regular type used we will not touch on that style, but confine our attention to what is known as the universal type. Fig. 7 illustrates the appearance of such a block. It will be noted that this block is provided with a hole, central with the V, by means of which it can be quickly and accurately set with the V, central with a spindle or to some other required position.

By using a block of this nature the usual tedious task of lining up the V-block on a face-plate is avoided, for it is a simple matter to indicate the hole and adjust it until it runs true. The hole also provides a clearance space for the drill or boring tool as the case may be. The clamping holes (which can be clearly noted on the illustration) go entirely through the block and are used by inserting screws from the back. A clamping groove is also provided in each side of the block.

Fig. 8 shows one of these blocks set up for the boring of a hole through a stud. In precision work it is essential that any hole bored through a stud must be absolutely accurate. It is in cases such as this that V-blocks prove their usefulness.

Of course we would not have readers imagine that V-blocks are only used to bore holes through studs. This is not

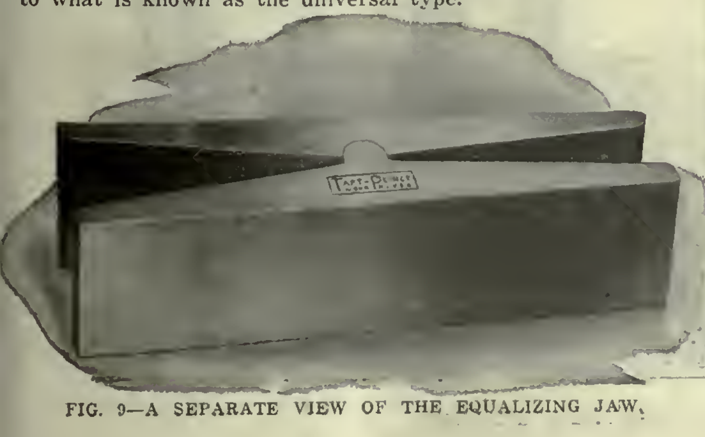


FIG. 9—A SEPARATE VIEW OF THE EQUALIZING JAW.

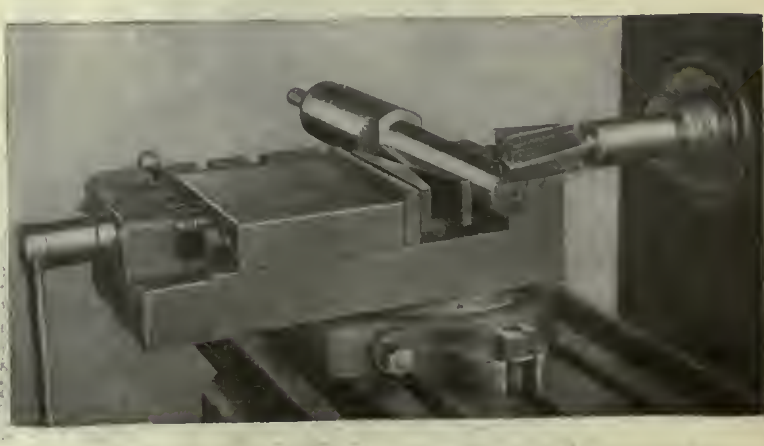


FIG. 10—THE EQUALIZING JAW IN USE, THE WORK BEING THAT OF GRIPPING TAPER SHANK.

FIG. 11—ILLUSTRATING TWO STYLES OF BOX PARALLELS.

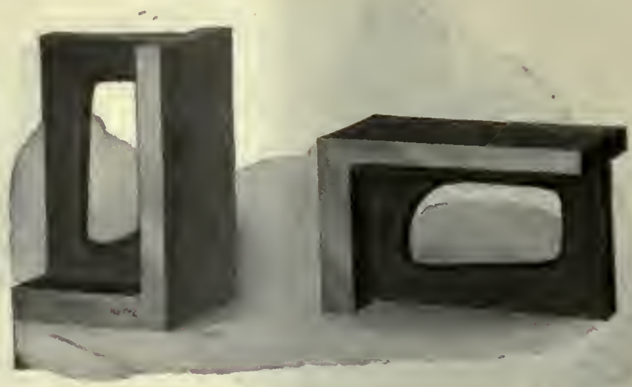


FIG. 13—SEPARATE VIEW OF A UNIVERSAL ANGLE IRON.

FIG. 14—HERE IS AN INTERESTING COMBINATION. A UNIVERSAL RIGHT ANGLE IRON, IN COMBINATION WITH A BOX PARALLEL, AND TOOL MAKER'S ADJUSTABLE KNEE.

FIG. 15 — ILLUSTRATING HOW BOTH THE LONG AND SHORT SIDES OF THESE UNIVERSAL SQUARES ARE TESTED.

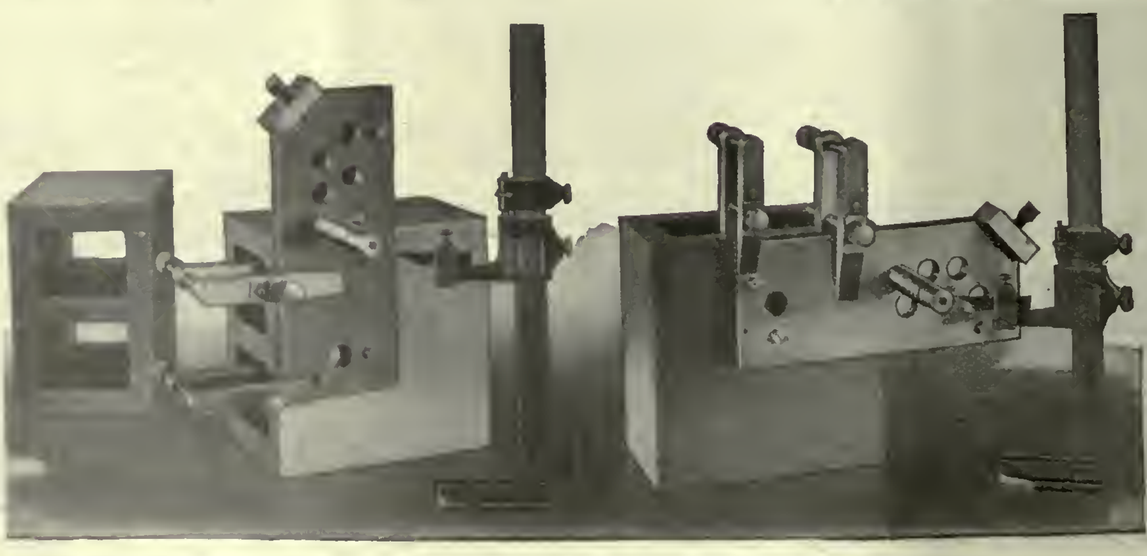


FIG. 12—SHOWING HOW BOX PARALLELS ARE USED.

FIG. 16—USING THE UNIVERSAL SQUARE TO SET THE SINE BAR FIXTURE FOR A SPECIAL MEASUREMENT.

our intention, for our idea is to point out the advantage of using a V-block, in conjunction with the lathe, whenever practical.

The Use of Equalizing Jaws

It often happens that equalizing jaws can be used to good advantage throughout the tool room. This is especially true if the piece to be gripped is of peculiar shape. At Fig. 9 we illustrate a pair of these jaws.

Jaws of such nature are often found equally useful for the general machine shop as well as the tool room, but in this particular case we will confine ourselves to the tool room. Time in set-ups is saved by the use of such a tool, not to speak of the secure grip which you are able to obtain by such a method. The circular fulcrum shown at the centre of the jaws holds them in position while the work is being clamped, and at the same time allows for adjustment to the angle of the work. A set of these jaws in use is shown at Fig. 10.

It will be noted that in this case the work being gripped is a taper shank, an object difficult to grip by any other method, but by means of an ordinary miller vise and a pair of these jaws the trouble is solved at once.

Parallel Blocks

The uses of parallel blocks are many. They are used on almost every machine tool for blocking up purposes, for set-up work, and so on. The ordinary solid type are used extensively on planer work, for raising the work on the bed, while the box type as illustrated at Fig. 11 are used more for gauge and inspection work. Of course some concerns adopt this type for blocking up purposes also, but for our purpose we will illustrate only their use for inspection purposes.

At Fig. 12 we illustrate by two separate views how the box parallel can be used to advantage. As these blocks are finished accurately all over they can be turned to any desired position, giving quite a large range to work on. The only reason they are cored is to facilitate clamping, at the same time reducing their weight.

Angle Irons

As in the case of the parallel blocks there are innumerable styles and sizes of angle irons, but we will confine ourselves to one style only, that being the universal right angle iron. This type of iron is shown at Fig. 13, while a combination of three production tools is illustrated at Fig. 14.

In this case we see a parallel block, an adjustable knee, and a right angle iron, all combined. This is one example which brings forcibly home the fact that accurate measurements can only be obtained with accurate tools.

Universal Squares

An inspection tool, not used as often as it might be, is illustrated at Fig. 15. This tool, known as a universal square, is accurately made so that it will test squares, even when held at an angle to the surface being inspected for squareness. The knife edge and straight sides are finished to a high degree of accuracy. Every square is tested on both sides as shown at Fig. 15, and as can be noted, the centre of the square is of web construction covered with a hard rubber insulation, which provides an excellent grip. These squares are especially useful in setting dimensions which must be extremely accurate.

Take for example Fig. 16. Again we have an illustration of a combination of inspection tools, for here we see the universal square being used to set the sine bar fixture to a special measurement.

Fig. 17 depicts what is known as a measuring iron. This tool is so designed that it may be clamped to the table of a machine or surface plate, and to provide a fixed surface from which measurements can be conveniently taken. It is particularly adapted for use in connec-

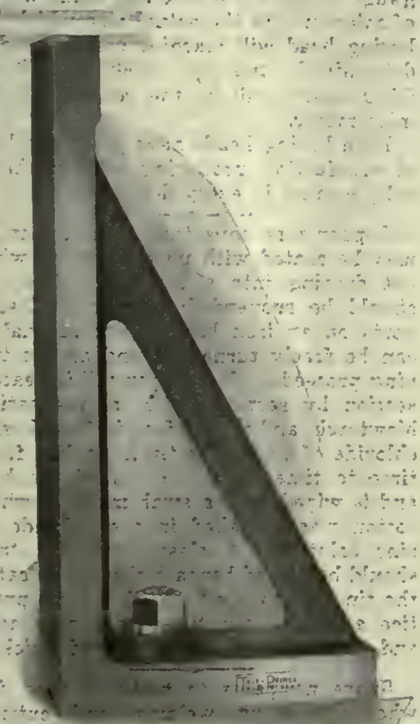


FIG. 17—A DETAIL VIEW OF ONE STYLE OF MEASURING IRON.

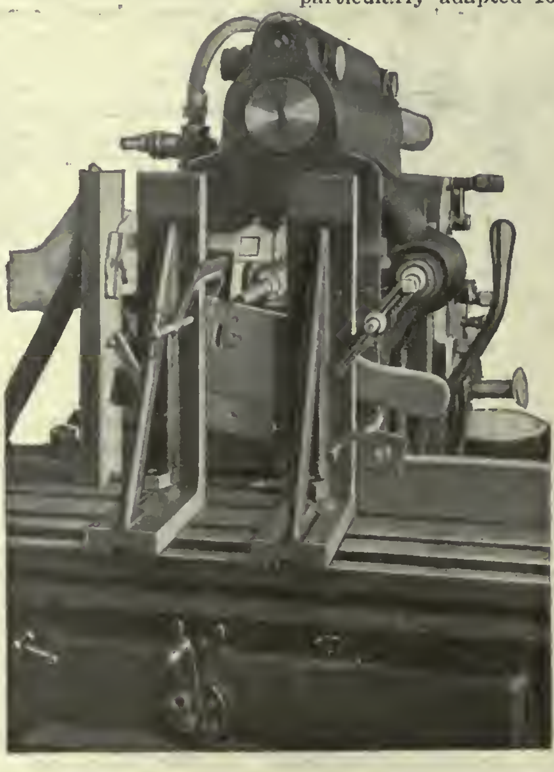


FIG. 18—A SET OF MEASURING IRONS USED FOR A BORING SET UP ON A MILLING MACHINE.

tion with accurate boring operations. As they are narrow, and occupy a small amount of table room, they provide a convenient means of clamping work while it is being machined.

At Fig. 18 we illustrate three of these measuring irons used in a boring set-up on a milling machine. Although shown on a milling machine these irons can be used equally as well on many other types of machine tools. Wherever a fixed surface is required, from which to take dimensions, the use of these irons will be found of great advantage.

Of course there are numerous inspection and production tools which we have not illustrated or described, including bench plates, indicators of all kinds, work centres, test plugs, etc., etc., but we have, however, pointed out the use of some of the more important tools with their attendant advantages.

To turn out accurate work, you must have accurate tools, handled by men who realize the necessity of care and accuracy. This condition makes for an ideal tool room, which in turn means accurate jigs and fixtures. Continuing the train of thought, we find that accurate fixtures mean an accurate product turned out at maximum speed, which, lastly, ensures an interchangeable product. From this we can safely conclude that all the aforementioned conditions are necessary in these modern days of keen competition and speed.

We would like to acknowledge our appreciation to the Taft, Pierce Co., of Woonsocket, R.I., who allowed us the use of the various illustrations throughout this article.

Two Interesting Styles of Boring Heads

By ROBERT MAWSON

A problem recently came up in our Mechanical Engineering Department to machine a large hole of 9 inches diameter.

This hole had to be concentric with a smaller one, accurate as regards size, and also parallel. The tool we designed for boring the large hole is shown in Fig. 1, and is known in the machine shop as a "Cat Head."

There are some features about the tool that are worth noting, especially regarding its construction. Most boring heads of this type are made too light and not sufficiently rugged. This is particularly the case with the boring or cutting tool proper.

Referring to the illustration: The body or holder "A" is made of a machine steel forging, accurately bored to suit the boring bar (which it might be added was supported on both ends in the head and tail members of a horizontal boring machine).

A flat was filed on the bar, and by screwing down a 7/16 inch set-screw in the tapped hole shown the boring head was held rigidly in position. The cutter "B" is made from a stock bar of high speed steel, suitably hardened.

To adjust the cutter for the correct diameter the screw "C" is first slackened and the square-head set-screw "D" tightened, which action forces out the cutter. After the correct size has been obtained the screw "C" is tightened and the cutter held rigidly in position for the machining operation. A pin was also driven through, and extended on each side of the boring bar. This pin fitted into the slot "E" and thus acted as a positive driving medium.

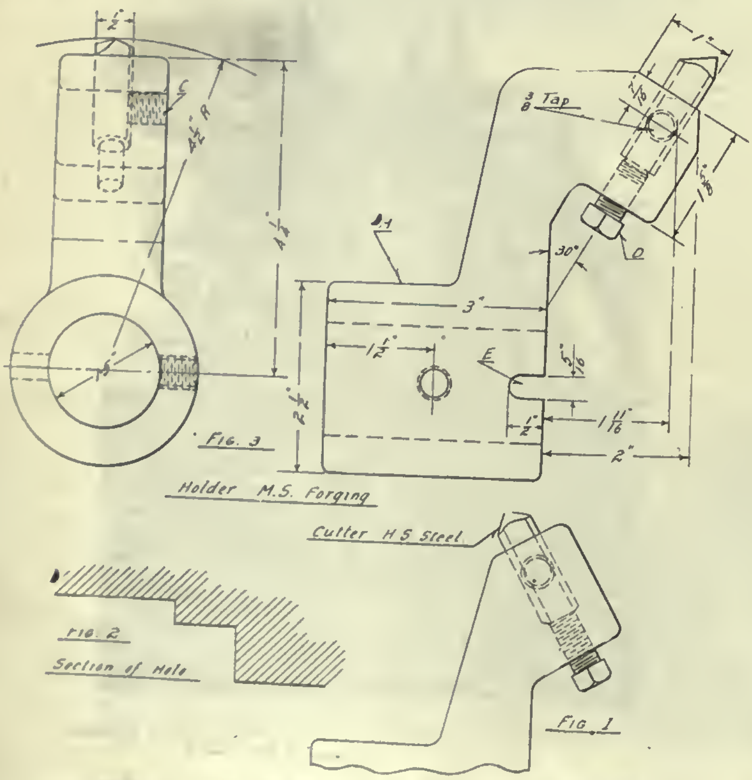
The boring head was a success as far as it went, but it can readily be seen that it has its limitations. For example, it is impossible to machine a hole to a square shoulder, in other words, it can only be used to machine a hole which goes entirely through the piece.

To meet these conditions (especially as one of the holes called for had a sharp corner as illustrated by the section, Fig. 2), the improved design of tool was made as shown at Fig. 3.

The head was made of a similar machine steel forging, the only difference being that the cutter was placed with the angle away from the vertical centre line instead of towards it as shown at Fig. 1. With this latter construction the cutting edge projects beyond the body of the tool and a sharp corner may thus be obtained.

A further advantage of the improved design is that by placing a bar or plug gauge in the 1.500 hole and using a pair of micrometers the actual size which the boring head will machine can be readily determined, namely, 4.500 + .750 = 5.250 inches will be the reading on the micrometer.

Both boring heads have given the best of satisfaction, producing holes mechanically correct in every detail.



GENERAL VIEW SHOWING THE TWO STYLES OF HEADS.

Copper pipe coils that require tinning may be coated with pure block tin without dipping into a tin bath. The coil should be suspended between two supports on an iron bar or pipe so that it can be freely turned around as the tinning proceeds. The copper coil is heated, section by section, with a preheating blowtorch, and the surface is fluxed with chloride of zinc. The tin is applied from time to time from the end of the bar, and is wiped with a swab made of white cotton waste soaked in the chloride of zinc solution. A clean wooden tray should be placed beneath the coil to catch the tin that runs off. With a little practice a welder can tin copper pipe coils and similar parts smoothly and quickly.

Spare no pains to make a good job when fitting up welding and cutting hose. Spread shellac on the nipples before forcing them into the hose. The shellac quickly hardens and makes not only a tight joint but a cemented joint uniting rubber to the metal.

Various Causes of Grinding Wheel Breakage

There Are Nine Important Reasons Why Grinding Wheels Break, According to the Author of This Article, Which Appeared in "Machine Tool Review." A Perusal Will Prove Worth While

By HAROLD E. JENKS

THE subject of grinding wheel breakage is one which directly concerns every wheel consumer as well as the manufacturer of the product.

Breakage of the wheel affects the consumer as well as the manufacturer of the product.

Breakage of the wheel affects the consumer, since it means danger to the operator and possibly to others in the shop. It also involves considerable expense due to the loss of the wheel itself and loss of time in procuring and mounting another one.

It affects the wheel manufacturer, since it is obviously for his interest to have as few breakages as possible charged up against his wheels, and since, if the cause of breakage is clearly due to manufacturing defects, he will be expected to replace the broken wheel at his own expense.

It is important, then, that wheel breakages should be reduced to a minimum. To do this, its underlying causes should be clearly understood, and it is with the purpose of making these causes clear that this article has been written.

Breakage of a grinding wheel while in operation may be due to any one of the following causes, or to a combination of two or more of them:

1. Centrifugal force due to rotation of the wheel.
2. Direct pressure exerted by the work on the wheel.
3. Heating of the wheel or spindle.
4. Grinding on the side of the wheel (side pressure).
5. Improper mounting.
6. Impact on the side of face of the wheel.
7. Cracks or flaws in the wheel structure.
8. Lack of balance.
9. Initial stresses.

It is unavoidable that these causes should overlap to some extent; for instance, heating of the wheel is a result of direct pressure by the work. It is thought, however, that the list has been condensed as much as possible to still retain the desirable property of clearness.

By "stress," as used here, is meant force acting betwen the particles of wheel material per unit of area let us say in pounds per square inch. Wheel material is much weaker under tensile stress than under compressive stress—that is, a much smaller force will break it if tending to pull its particles apart than if tending to push them together. For this reason, stresses are herein specified as tensile or compressive, it being understood that compressive stresses are not important as sources of breakage. Mathematical proof of statements made regarding the amount and position of stresses in wheels is beyond the scope of this article, and is therefore omitted.

Much importance should be attached to the fact that although not one of the existing stresses in a wheel may be excessive, the combination or resultant of two or more of them may be sufficient to cause breakage.

Centrifugal Force Due to Rotation of the Wheel

In any body which rotates about an axis, stresses are induced at every point due to centrifugal force, which is the force tending to make the body fly apart. In a grinding wheel these stresses are of two kinds: a radial stress acting in the direction of the radius of the wheel; and a tangential stress acting in a direction perpendicular to the radius. Both these stresses are tensile. The tangential stress is much the larger of the two, and reaches its greatest value at the inside of the wheel—that is, around the circumference of the hole.

The radial stress has its maximum at a point from one-third to three-fourths the distance from the face of the wheel to the hole. The amounts of both stresses vary as the square of the wheel speed, which means that if the speed is doubled the stresses are quadrupled. For a given peripheral speed and diameter of wheel, the maximum tangential stress increases slightly as the diameter of the hole is made larger, and in cylinder wheels becomes about 20 per cwt. greater than in disc wheels with ordinary sized holes.

Since a grinding wheel in operation is always revolving, stresses due to centrifugal force always exist; and although it is probable that comparatively few wheels in operation break from these stresses alone, others may easily combine with them and produce breakage.

Reliable grinding wheel manufacturers test all wheels before they leave the factory by running them at such speeds that the minimum safety factor is 2½ and the maximum in some cases as high as 5. As a result of this precaution, practically all breakages that occur from centrifugal force alone can be traced to such causes as shifting thoughtlessly from large to small pulleys, placing large wheels on spindles running at speeds intended for small ones. or substituting for a wheel running at the correct speed one of different grain and grade and lower recommended wheel speed. In other words, these breakages are nearly all due to carelessnes or ignorance on the part of the operator.

Direct Pressure Exerted by the Work on the Wheel

By "direct pressure" is meant pressure on the face of a wheel directed toward its centre. Stresses produced by this pressure are of two kinds—radial and tangential, or frictional.

The radial stress is the same as would be produced by direct pressure, if the wheel were not revolving, and is compressive. It is usually small in amount and is unimportant as a cause of breakage.

Contact between the particles of the revolving wheel and the work produces a frictional force whose amount is proportional to the direct pressure and which is in the direction of a tangent to the wheel face. This force causes bending stresses along a diametral section of the wheel which are tensile on one side of the centre and compressive on the other. These stresses reach their largest value at the face of the wheel, and are usually small and unimportant.

Heating of the Wheel or Spindle

Considerable heat is developed at the point of contact of wheel and work, and in cases where grinding is done dry the wheel may become very hot. The stresses produced by unequal expansion of different parts of the wheel may in this case reach a large value, and many breakages are probably due to this cause. These stresses are similar to those resulting from centrifugal force, and are (as in that case) of two kinds—radial and tangential. THEY MAY VARY GREATLY IN AMOUNT ACCORDING TO VARIATIONS IN TEMPERATURE OF THE WHEEL, AND AN EXACT DETERMINATION OF THEIR AMOUNT IS DIFFICULT, IF NOT IMPOSSIBLE. The greatest tensile stress occurs around the circumference of the hole and hence combines with the greatest stress due to centrifugal force.

Heating of the spindle may be produced by tight bearings on the machine; and if the wheel bushing fits the spindle tightly, expansion of the latter will cause tensile stresses of considerable magnitude in the wheel, which, adding to the maximum stress due to centrifugal force, may cause breakage.

Grinding on the Side of the Wheel (Side Pressure)

Many breakages are directly caused by side pressure, which occurs to a limited extent when work is being traversed across the face of the wheel, but principally when grinding is done on its side. Also, particularly in snagging operations, large side pressure may be produced by grinding on or "working" the corners of the wheel face. The effect of side pressure is to produce a bending stress whose maximum reaches all points of the wheel as it revolves, and which is tensile on the side of the wheel which sustains the pressure and compressive on the other.

Properly designed flanges used on wheels of sufficient thickness are the best protection against breakage due to side pressure. They not only greatly reduce the maximum stress due to this pressure, but prevent its attaining its maximum at the circumference of the hole, where it would otherwise combine with the maximum due to centrifugal force.

Improper Mounting

This subject is of such importance to all grinding wheel users that it is thought advisable to first give the following brief statement of the essentials of correct mounting:

Care should be taken that the sides of the wheel and the sides of the flanges in contact with the wheel are plane surfaces, in order that an even bearing may be secured.

The hole should be of a diameter approximately .005 in. larger than the spindle or arbor on which the wheel is to be mounted, and must be at right angles to the sides of the wheel, concentric with the circumference. No portion of the bushing should project beyond the sides of the wheel.

The spindle should be perfectly straight and threaded in a direction such that any tendency for the wheel and nut to turn will tighten the nut.

Flanges are used primarily to transmit power from the shaft to the wheel, and for this reason the inside flange must be keyed to the shaft. Both flanges must have plane faces at right angles to the shaft, and should be properly relieved —that is, they should be countersunk so as to bear on the wheel only on the part of the side of the flange nearest the rim.

Blotters or some other form of compressible washers should be used between flange and wheel to insure an even bearing. Their diameter should be at least as large as that of the flanges.

The nut should be tightened only enough to properly hold the wheel. Further tightening is unnecessary and undesirable.

Stresses in the wheel due to improper mounting are particularly important because they all combine directly with the maximum due to centrifugal force.

Forcing a wheel on a spindle for which its hole is too small is extremely likely to result in breakage, as large tensile stresses are induced around the circumference of the hole. If the hole is too small, it should be carefully enlarged by scraping until a perfect fit is obtained.

Side pressure producing large tensile stresses may result from any defect in mounting which tends to produce uneven bearing between flanges and wheel, such as bent or broken flanges; projecting bushings; high spots on bearing surfaces of flanges or wheel; flanges not properly relieved; failure to use proper compressible washers; flanges of different diameters, or excessive tightening of the spindle nut.

Impact on the Side or Face of the Wheel

Probably most breakages due to impact are the result of carelessness or ignorance on the part of the operator. It should be borne in mind that stresses in a wheel produced by a suddenly applied force are very much larger than those produced by the same force if applied gradually.

The impact of the particles of the wheel on the work in any form of grinding produces certain stresses in the wheel, but these are carried more by the particles in direct contact with the work than by the wheel as a whole, and are not important as a cause of breakage. Cases have been known, however, where ignorant operators, in order to increase the speed of cutting, have hacked the face of the wheel in such manner as to cause breakage due to this form of impact.

Breakages are sometimes caused by bringing heavy pieces of work into too sudden contact with either the face or side of the wheel. Carelessness in snagging castings suspended from chain hoists, for example, might easily produce breakage of this kind.

In work requiring a table traverse, the headstock of footstock may be run into the wheel, which will cause wheel breakages unless something else gives way first. This is not true impact, but approaches it on account of the suddenness of application of the force, and results in larger stresses due to side pressure.

Catching of the work between the wheel and the rest in free hand operations is very likely to cause wheel breakage. Such an accident may be due to improper adjustment of the rest or to lack of attention or ignorance on the part of the operator, and may have very serious consequences. This is a case of true impact, the speed of application of the force being practically the speed of the periphery of the wheel.

Cracks or Flaws in the Wheel Structure

Wheel breakage sometimes occurs because of cracks or flaws which are in the wheel before it is put in operation. Such defects may be entirely under the surface of the wheel and therefore not visible. Flaws are manufacturing defects, while cracks may be due to faulty manufacture or to various other causes, such as carelessness in transportation, handling, unpacking, or storage.

Due to the fact that the Norton Company uses such extreme care in testing wheels for flaws and cracks, it is practically impossible for a wheel with such defects to pass inspection and be shipped outside the factory.

The "ring" of a wheel, or sound produced by its vibration when tapped lightly with some solid object, is used as one indication of interior cracks or flaws. A wheel with a clear "ring" is fairly certain to be free from such defects, although it has been shown that a poor "ring" does not necessarily mean a defective wheel. Norton Company, however, in order to be on the safe side, rejects all wheels which do not ring clear.

After the test by "ringing" the wheel, all wheels of over 5-in. in diameter are given a speed test at about double the recommended operating speed, as stated previously. This is a very severe test and is practically certain to eliminate defective wheels.

Rigid inspection follows this speed test and the wheels are very carefully packed for shipping in strong boxes made especially for the purpose.

Breakages due to cracks are therefore beyond the control of the Norton Company, since these cracks must occur subsequent to the time the wheels are shipped.

Lack of Balance

A wheel that is out of balance has developed in it stresses of rather complex character. In cases where the lack of balance is very great, breakage may result, either from these stresses or from impact, as will appear below. Lack of balance may be due to several causes, the description of which follows:

Variations in density in a wheel may cause imperfect balance. However, this can hardly prove serious in the case of wheels furnished by any reliable grinding wheel manufacturer, as the homogeneity of structure of such wheels precludes the possibility of a dangerous amount of lack of balance.

If a wheel goes out of true for any reason, it will also go out of balance, since its centre of rotation will no longer be at its centre of gravity. Wheels may go out of true from such causes as a bent spindle, loose bearings, loose frame, improper use, or from the hacking of the wheel face previously mentioned. If a wheel is seriously out of true, it will deliver a series of blows to work thrust against it, thus producing large impact stresses. The stresses due to the centrifugal force of the out of balance portions of the wheel may also become large in this case, and will combine with the maximum due to centrifugal force.

A wheel should not be allowed to stand partially submerged in water or other liquid, for when it is started in motion the wet portion is much heavier than any other and hence the wheel is greatly out of balance. Several cases of breakage from this cause are known.

During the process of manufacture of any solid body, initial stresses are sometimes set up in the material of which the body is composed. Unless great care is used in its manufacture, a grinding wheel may have such stresses existing in it. These may be regarded as incipient flaws or cracks, and may combine with other stresses to increase the maximum stress in the wheel. No method has yet been devised for determining the existence of initial stresses in wheels.

However, Norton Company by the speed test mentioned above eliminates from its finished product all wheels with large initial stresses. By running all wheels at double the recommended operating speed and thus quadrupling the stress due to centrifugal force, any wheels having extraordinary initial stresses are broken.

On account of the number and variety of the possible causes of wheel breakage given above, it is easily seen that the actual determination of the real cause of breakage of a single wheel may be difficult or impossible. In cases, however, where breakages occur consistently with a certain operator or on a certain machine or operation, it may be reasonably assumed that there are one or two principal causes involved which can by a study of the situation be detected and removed.

A conservative statement, based on experiments, investigation, and long experience with wheel breakages, is that practically all breakages are due to causes beyond the control of the grinding wheel manufacturer and may in no way be attributed to weakness in wheel structure.

Boring Jig for Valve Covers on Air Pump

By ANGUS McALPINE

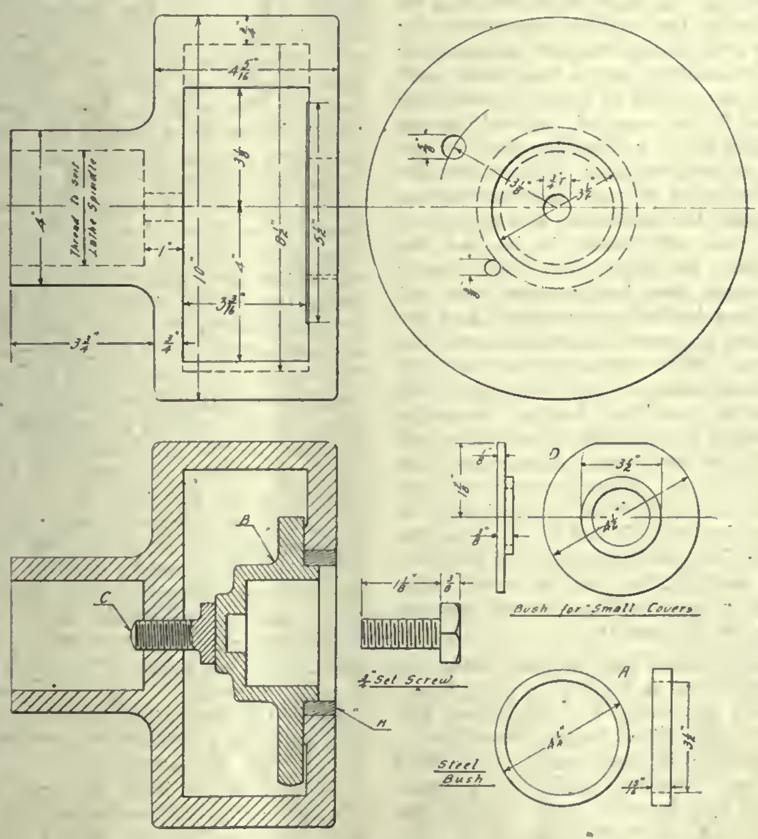
THE accompanying sketch shows a jig for boring the main valve covers of Westinghouse air pump. After being on the road a while, these covers show wear, and have either to be trued up or bushed. The ordinary method is to put the cover in an ordinary dog chuck, catching them by the outside edge of flange.

This is a very important operation, and the work has to be accurately performed, consequently a great deal of time has to be spent setting up. The time spent setting up has become a bugbear, and when the covers come singly they are generally scrapped and a new one applied.

Of course, when twenty or thirty come in from the line, they have to be repaired, and it was to meet such requirements that this jig was designed. The jig itself is just a circular box chuck which is applied to the lathe spindle.

The front is bored out 4¼ inches and hardened mild steel, bush A pressed in. A machining strip is left on the back of the front face for flange of bush to be applied to. Cover is slipped into chuck and the lip on same fits into the mild steel bush. Set-screw C is then brought to bear on cover, forcing flange against the inside face of chuck, automatically trueing the job.

If the set-screw pressure is not sufficient, a driving bolt can be applied through hole in chuck and bolt hole in flange of cover. The sketch is for 11 in. pump, but when the 9½ in. size is to be machined, the bush D is applied.



VARIOUS VIEWS OF THE FIXTURE.

LETTERING ON METAL SURFACES

By Donald A. Hampson

Once in a while there comes up a job of lettering out in the shop to which a draftsman falls heir because of his experience on similar (?) work on the drawing board. Two instances of this kind will be related, for they may help someone else who suddenly finds that lettering on metal is quite different from paper.

It was desired to bring the cast letters of the maker's name into greater prominence by gilding them. The 35 cent packages of gilt put up for household use are all that is needed for the work, but the brush supplied with them is too large and a striping brush must be selected; this will make a line from one-sixteenth to an eighth of an inch in width. The gilt must be mixed quite thin, and only enough carried on the brush for a single line. The flexibility of a brush is in marked contrast to the firmness of a pencil, and some practice will be necessary to get used to making a line by drawing the brush along on its side instead of using the point. Too much gilt will cause horizontal lines to break and run; it will cause vertical ones to bulge at the bottom. Where there is no good support for the hand, a light stick, held in the left hand and resting upon another part of the face, bridges the gap and steadies the marking hand.

Another instance was that of a metal cabinet having about three hundred sizes stamped on the front with ¼-inch figures. Against the green background these did not stand out as they should, and it was decided to make the sizes white. White enamel was used for this, and as it was an impossibility to trace the shape of the figures with a brush, an eighth-inch brush was used to fill the depressions in rough approximation of the stamped shape. The worst of the excess was wiped off with a linen cloth wrapped around the finger. Then a piece of soft rubber, trimmed square and straight, was drawn over the surface, removing effectually any blur remaining from the previous operation and leaving the letters standing out sharp and white.

An alloy of zinc and copper, the composition of which, it is stated, metallurgists have made every effort to determine without success, has made its appearance in Italy, where it has quickly demonstrated its usefulness. It is called Biakametal and United States Trade Commissioner H. C. MacLean, at Rome, has sent a report on it to the Department of Commerce at Washington. A new company having a capital of $2,316,000 has been formed to carry on its manufacture. It is said to have a high limit of elasticity and high resistance to thermic and to chemical action. It can be cast, turned, drawn, forged, rolled and stamped and has proved useful in aeronautic and marine construction on account of its relatively light weight and unusual strength and anti-corrosive qualities.

WELDING AND CUTTING

Fusion Welding Applied to Drop Forgings*

By S. W. MILLER

It has been found that in such steels, particularly where the piece welded is of considerable size, the quenching effect of the cold metal produces a zone of sorbitic character next the weld, which may start a detail fracture under alternating stress. The work referred to is of the nature of adding material to worn shafts in order to turn them up again to the proper size. While the welding is successful, the alteration of the structure is dangerous. This difficulty can be readily overcome by preheating the shafts to a high enough temperature to prevent the formation of the brittle zone. This temperature would depend on the size of the shaft, being less for a large shaft than for a small one. The slow cooling, due to the preheating, prevents the formation of sorbite and no trouble is experienced.

With oxy-acetylene welding, this defect does not exist, as the piece being welded must be brought to a high temperature before any welding is done, and this is sufficient to anneal the material near the weld.

Breaking Welded Pieces by Test

In making tests of welded pieces, it is essential to know the qualities of the material being welded if fair comparisons are to be made; for instance, in very soft material, having a tensile strength of about 50,000 lb. per sq. in., where the weld is of the same section as the rest of the piece, the chances are that a sound weld made by either process will be strong enough to break the original material, so that the figures obtained are those of the original material and not those of the weld. On the other hand, if the original material is of 60,000 lb. tensile strength the chances are that even with the weld somewhat reinforced the break will take place in the weld. The writer feels it necessary, therefore, to measure the elongation, not only in the total gauge length, but in each inch between the gauge marks in order to be sure of what the figures do represent. In the net results given above for oxy-acetylene welds, the yield points are those of the welds, while in the tests given below for electric welds the yield points are those of the original material.

	T.S.	Y.P.	Elongation in centre 2 in.	Broke
Electric ..	51,200	......	...	Outside Weld
	51,600	31,300	...	Outside Weld
Welds ...	51,300	33,300	7.5%	Inside Weld
	50,500	32,200	7.0%	Inside Weld

As stated before, the elongation of electric weld material itself is very low, and the yield point, therefore, is very close to the ultimate strength. It will be noticed that the elongation is very small and an examination of the test pieces will show that most of it is in the original material.

While it is not always of great importance in the repair of drop forgings to consider the character of welds with regard to their soundness, because usually welds are not made in parts which require great care in order to get the best results. It may be of interest to know that in the writer's experience the quickest and easiest way of determining a welder's ability is to have him weld together two pieces of ½ x 2 in. ordinary bar steel in the case of gas welding, or two pieces of ½ x 3 in. bar steel in the case of electric welding. The reason for using the wider piece in electric welding is that both the beginning and end of an electric weld are liable to be bad for ½ in. from the edge. The beginning is bad because the temperature has not been raised to the proper point and the end is bad because the temperature was too high. With oxy-acetylene welding the temperature at the beginning and end can be regulated by the operator. The electric weld should be machined off for ½ in. on each side, leaving the piece about 2 in. wide. If such pieces are then clamped on an anvil or heavy block, so that the bottom of the V is on a line with the face of the anvil, and the projecting part of the piece is struck with a sledge, a very good and rapid test can be made of its quality.

It will be found that electric welds are very brittle and will not give much bending, while gas welds will bend down flat and will even stand further bending before cracking on the outside of the weld if they are properly made. An examination of the fracture will indicate the mechanical soundness of the weld. Beyond this the welder cannot go, as he has but little to do with the metallurgical character of the weld.

Welding Heat Changes Structure

The physical structures of welds are of great interest and importance. In most cases they are what would naturally be expected from the high temperatures involved in the welding operation, but in the oxy-acetylene welds made with ordinary material, the weld is coarse-grained, and, on account of the distribution of heat, the grains are approximately equi-axed. Most of the carbon has been burned out by the heat so that what is left exists as isolated particles of cementite at the grain boundaries, as in very low carbon steel. There is always present more or less oxide, which is readily seen in an unetched section as small, round, dark dots. There are frequently minute holes, probably caused by the escape of occluded gases during cooling. Especially in the tops of welds made with a heavier tip than necessary, there are plates and needles of what is probably nitride of iron, due to the combining of the nitrogen of the air with some of the iron. The material next the weld is coarsened by the heat and somewhat decarbonized for some distance below the original surface. Between the body of the weld and the original material there is a zone of gradually changing carbon content as would be naturally expected. In this zone, unless proper fusion has occurred, there are liable to be films of oxide of great thinness, which are not visible in the polished section but which etching shows up distinctly. These films are of the order of a 1/50,000 in. thick, and have the effect of causing the weld to break along the line of the V; greatly decreasing its tensile strength and elongation; they are also fatal under alternating stress. Similar defects are liable also to be in the body of the weld where it has been poorly made; but they do not exist in any place in a properly made weld. The burning out of carbon and the presence of oxide dots cannot be avoided, and they are the only defects which should exist in a good oxy-acetylene weld. The nitride of iron is probably of little importance as far as ultimate strength is concerned, although it may have some effect on the elongation, and, as it should not exist in a good weld, its effect can usually be neglected.

Electric welds have the same general characteristics as oxy-acetylene welds, the difference being in degree only. The grains are frequently columnar, their log

*Continuation of a paper presented before the Sixth Annual Convention of the American Forge Association, Pittsburgh, June 14th. The author is proprietor of the Rochester Welding Works, Rochester, N.Y.

axes being perpendicular to the surfaces of the Vs in the original material. The layers of metal applied later refine the grain of the first layer, changing the columnar structure to an equi-axed one, so that some discretion must be used in interpreting this and other features of such welds. The reason for the columnar structure is the very rapid cooling due to the great localness of the heat. The same result is produced in ordinary steel ingots by the old walls of the moulds. The coarsening of the grain in the original material occurs in electric welds as well as in oxy-acetylene ones, but to a less extent because of shorter time of application of the heat. In all fusion welds there is a zone at some distance from the weld line in which the grain is much finer than in the original material. This zone is further away from the weld with the oxy-acetylene than with the electric process. Its distance varies with the thickness of the piece, being greater with thicker pieces, and is about 1½ in. in the case of a gas weld made in ¾ in. steel plate. Electric welds contain larger amounts of oxide than do oxy-acetylene welds, and they are also much more subject to defects in the form of oxide films and slag pockets for reasons already explained.

Nitride of Iron in Arc Welds

The special difference between electric and oxy-acetylene welds, however, is in the presence of large amounts of nitride or iron, which, as explained before, is caused by the nitrogen of the air combining with the iron at the very high temperature of the arc. Although this material has not been isolated as yet, a comparison with material that is known to be nitride of iron leaves little doubt of its identity. Nitride of iron resembles cementite very strongly with ordinary etching, although it does not blacken with sodium picrate etching, as does cementite. Nitride of iron, when present in sufficient quantities, apparently forms a eutecoid with iron which very much resembles pearlite. All steels contain some nitrogen, but because there are many difficulties in the way of making analyses, not only for nitrogen, but for other gases or their compounds, and in view of the newness of the subject it is not to be wondered at that there are no accurate data as to the amounts of nitrogen in welds. Reasoning from analogy, however, it is probable that the average electric weld contains something in the neighbourhood of 0.2 per cent. nitrogen, which, if the formula of iron nitride be Fe_4N, would give 1.8 per cent. iron nitride. The appearance of an electric weld would lead one to believe that there is at least this amount of iron nitride present. The appearance of iron nitride varies from that of exceedingly thin plates of brilliant white material to masses of some size, and still further to the eutecoid referred to above. The plates are exceedingly thin, being probably at times of the order of 1/10,000 in. thick, and in many cases they appear in an etched section as dark lines of some thickness, but this is doubtless due to the acid eating off the corners of the metal next to the plates and making a groove which of course shows dark in the microscope. These plates lie along the same planes in the grains as do Neumann lines and do not lie along the slip planes. It is doubtless for this reason that they have but little effect on the strength or distortion of an electric weld. As the amount of nitride increases it collects in large masses, which finally appear as eutecoid. In the writer's opinion these masses of iron nitride contain some iron carbide, because parts of the spots darken with sodium picrate etching or with heat tinting, while in pure iron nitride there appears to be no such effect.

Reference has been made to the path of rupture in welds. As a comparison it may be stated that in sound iron or steel this path is always through the grains along the slip planes. In sound oxy-acetylene welds made with usual welding materials, the same path is followed, while in electric welds the path is, within the writer's experience, always along the grain boundaries.

PROCESS FOR REMOVING RIVETS AND CUTTING METALS

A recent invention by the Societe Anonyme d'Acetylene Dissous relates to a process for removing rivets and cutting metals by means of the electric arc.

Certain work in boiler construction and particularly in the repairing of ships in consequence of stranding, collision and the like, necessitates the removal of a large number of rivets. Formerly this removal was effected by cutting off one head of the rivet with a hand or machine tool and then punching the rivet out, but of late, use has been made of the oxygen process of metal cutting. The head of the rivet is first heated by the flame of the blowpipe cutter, and on reaching a suitable temperature is burnt off by a supplementary oxygen jet.

Also electricity has been used for separating or fusing the members of metallic structures by bringing a carbon electrode connected to one pole of any source of electricity into contact with the metalic material which is to be separated, the latter being connected with the other pole of the source of electricity. As is well known in all fusing operations in which an electric arc is used, the metal, as soon as it melts, is liable to oxidize and the oxide formed interferes with the heat transmitted by the electric arc and considerable time is lots in the operation.

The object of the present invention is a process which effects the removal of rivets or cutting of metals by means of the electric arc without any loss of time.

The process consists essentially in fusing the head of the rivet by an electric arc of suitable intensity, and at the same time enabling the metal of the rivet head to combine with substanaces adapted to form therewith compounds which are sufficiently fusible and liquid at the working temperature to flow readily, or be blown away by the wind of the arc. To this end the metal piece of which the rivet forms part is connected to one pole of a source of electricity, whilst the second pole is connected to an electrode consisting of an iron or steel rod, the diameter of which may vary between 1-16 inch and ⅜ inch, and which is covered by a coating containing the substance which is to enter into combination with the metal of the rivet head. As soon as the electrode is placed in contact with the rivet head the arc develops and the metal and the rivet run away in the form of liquid slag, without loss of time. The most suitable substances for making the coating of the electrode are oxidising substances, fluxes such as borax, and silicates, and substances such as carbon, which form fusible alloys with iron. Particularly interesting result are obtained with a coating essentially composed of hydrated silicates to which a small amount of carbon in powder form may be advantageously added. With an electrode about 3-16 inch diameter coater with such a covering 1-16 inch thick, and with a continuous current of 250 to 300 amperes, the head of a counter-sunk rivet 1 inch diameter can be destroyed in about 20 seconds.

It should be understood that without departing from the scope or the invention other means than the above described may be used for the purpose of bringing into contact with the heated metal, substances adapted to enter into combination with same and form fusible products, for instance the fusible substances may be arranged in the form of a rod or the like along the electrode.

It should be remarked that the metal of the rivet head is not necessarily entirely converted into slag or fusible alloy. Part of this metal can be carried away, as is the case in the process with blowpipe cutters, in the slag or fusible alloy without having entered into combination.

The diameter of the electrode and the intensity of the current may vary within fairly wide limits. Nevertheless a current intensity of 250 to 300 amperes (continuous current) should not be exceeded when it is desired to remove rivets without deteriorating the plate in which they are fixed.

This process can be employed with alternating current and for piercing and cutting plates and beams, but it is of more particular interest for the removal of rivets.—"Acetylene & Welding Journal."

A new heat insulating material is being produced in Sweden which is stated to be very promising, says the "Electrician." The chief constituent in this new material is a kind of clay found on the island of Mors. This "molera," as it is termed, is very porous, and each grain appears to be hollow. This fact is no doubt largely responsible for the good heat insulating properties. After it has been burnt the molera becomes extremely light. Before it is burnt it is mixed with cork. The new insulator is said to be primarily suitable for the lagging of steam pipes and boilers, but may also have uses for the production of soundproof chambers, and as a medium to check the transmission of vibration.

DEVELOPMENTS IN SHOP EQUIPMENT

THE OLIVER NO. 1 UNIVERSAL PATTERNMAKER'S VISE

The Oliver Machinery Company, of Grand Rapids, Mich., have just placed on the market a new and improved patternmakers' and general woodworkers' vise, known as the Victor patent, which has many features worthy of notice. A few views of the vise and its capabilities are shown in the accompanying illustrations.

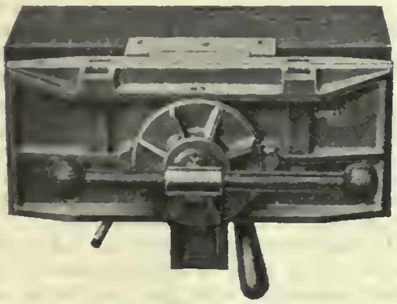


FIG. 1.

Fig. 1 illustrating the Oliver No. 1 universal vise in natural position, flush with the bench top. One is at once impressed by its sturdy and finished appearance—it is the last word in vise construction. Yet only fifteen parts are used and every part is interchangeable. Although the jaws appear lighter, yet, because of the deep web construction they are actually stronger, and under

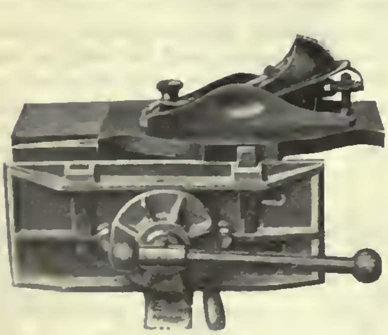


FIG. 2.

test have shown ability to withstand at least 300 pounds more pressure than jaws of other vises.

Fig. 2 shows that there is no limit to the work that can be done with this vise. It will securely hold all classes of work that any patternmaker or woodworker will need it for. This illustration shows the holding dogs for use in surface working on thin wood. Their use is also of great advantage in panel and framing work. Their utility can be further augmented by arranging additional dogs (hardwood) in the top of the work bench directly opposite those in the vise for holding forms or cases.

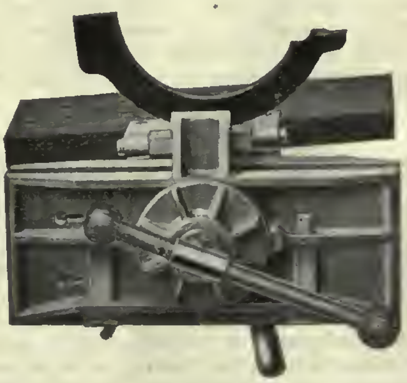


FIG. 3.

Fig. 3 shows the vise swung around and the pair of jaws provided for the holding of metal parts thrown into position to hold the metal parts to be worked upon. The sturdy construction of every part of the vise and its adaptability for every purpose is here plainly shown. The screws of the vise are double thread 4-pitch Acme, cold-rolled steel of ⅞-inch diameter. The weight of the vise is only 75 pounds.

Fig. 4 shows the vise in one of the many convenient positions in which it can be set, to easily handle irregular-shaped work. Because the jaws turn on the beam when set to revolve they may be located and clamped at any desired angle (not at particular set angles as on

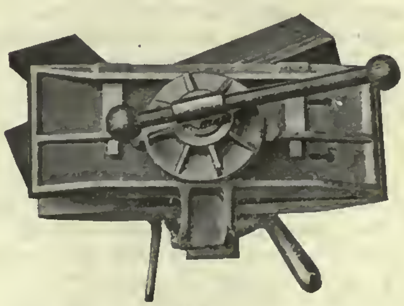


FIG. 4.

the obsolete types). The hand-operated, adjustable collar makes the adjustment for odd shapes and wedges a simple and speedy matter.

Fig. 5 shows the vise holding wedge-shaped work. The jaws are made to swing, being pivoted in the centre, so wedge-shaped work will fit either end of the jaws. The hand-operated adjustable collar makes the adjustment simple and easy. Note also the finished and substantial construction of the hub, which is part of the back jaw; the hand clamp lever used for revolving jaws and the beam, which in most every position

FIG. 5.

protects the screw from foreign matter, being closed side up.

Fig. 6 shows the vise in upright position with tilt or angle jaw in place. Note the rack bar which is used for clamping jaws in any angular position. This bar is flat and holds very rigidly, whereas

FIG. 6.

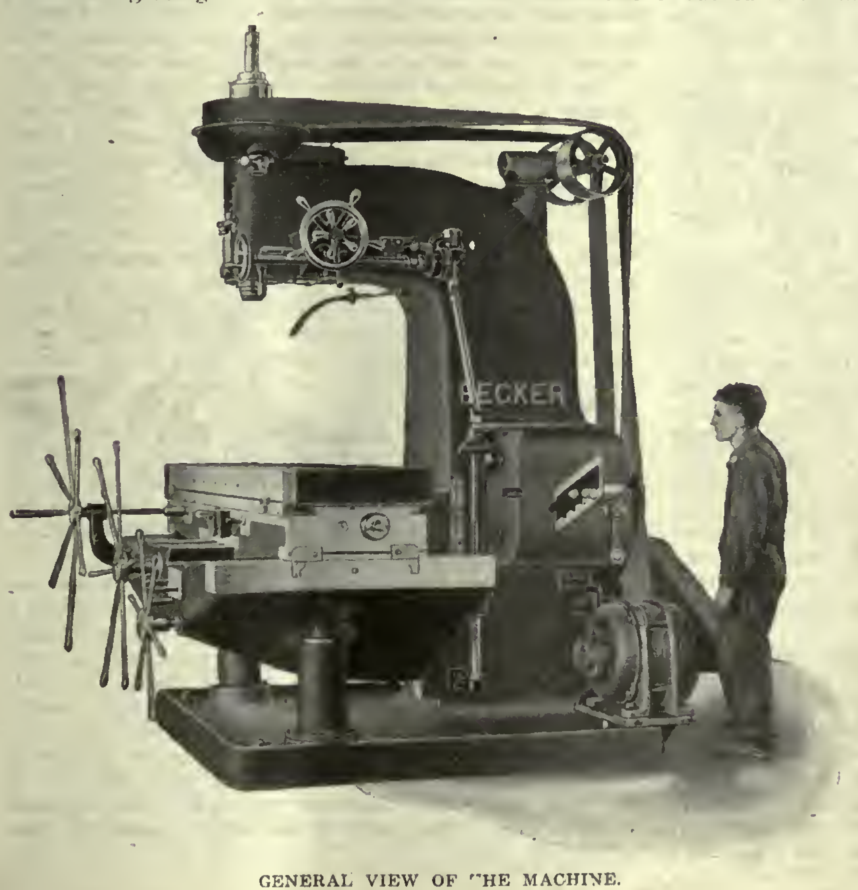
on other vises this is round and often allows the work to slip from its angular position. The jaws of the Oliver Universal No. 1 are smoothly finished; they are 7 inches by 18 inches in size, and have an opening of 15 inches. Its many special features make this an indispensable tool for the patternmaker's bench.

BECKER DIE-SINKING MACHINE

The Becker Milling Machine Co., Hyde Park, Boston, Mass., have recently added to their line of milling machines. This new addition is known as a Model D-1 die sinker, and is said to have an exceptionally wide range and capacity. The machine was designed primarily for die-sinking, where an ample range is required owing to the size of the largest dies which run up to 10 tons in weight, and at the same time is capable of performing accurate die-sinking operations. The light spindle allows great ease of manipulation, which is necessary to get the delicate adjustment required to "follow the line" with convenience to the operator. This machine incorporates most of the improved features of the later types of milling machines manufactured by this company, together with many new and valuable improvements. It is rigidly constructed, and the knee, saddle, and table have been made exceptionally rugged. The knee, which is of great width, is elevated and lowered through two telescopic screws that are connected by gearing to move simultaneously, and being perfectly co-ordinated they are controlled by a single lever. In order to correct the alignment of the table, due to wear of the mechanism, an adjustment is provided on each screw. These screws also provide a double support for the knee, each screw being well out from the centre of the machine to prevent undue deflection in the table caused by the numerous stresses incident to the large overhang when the table is moved to its extreme limit on either side. The knee is also supported by the frame or column of the machine by means of the Becker patented knee gibbing.

The knee is reinforced by heavy ribs running in both directions, which are cast on the inside, and the spaces between the ribs on the top surface are closed by hand hole covers which prevent the accumulation of dirt and chips. The saddle is the same length as the table, namely, 96 inches, and slides on a tapered gib at the centre of the knee, having in addition a wide flat way at each end, thus providing five generous bearing surfaces. The table is attached to the saddle by a straight gib and has a bearing the full length of the working surface, and it is provided with power rapid traverse in either direction, also a fine hand adjustment which is controlled from the front of the knee or at either end of the table. There are three ¾-inch T-slots in the table, oil-grooves on the side, and an oil-pan at each end for collecting the cutting lubricant, which is returned to a tank cast in the base of the column by means of a flexible metallic tube.

A particular feature of this machine is the centralized control, which allows the operator, standing in his position at the front of the machine, to operate all hand and power feeds conveniently. Adjustable stops are provided for all of the various movements. The spindle is back-geared and driven by a 5-inch double waterproof belt, which transmits power to the spindle quite uniformly and gives to the work the smooth finish so much desired in die-sinking and similar work. The spindle is of the "barrel type" of construction and is provided with an adjustable automatic stop, a micrometer stop gauge, fine hand adjustment, and a quick-return mechanism. The spindle is made of crucible steel and it is carried in a conical sleeve bushed with hard bronze bearings. Collars are provided for adjusting to compensate for wear in the bearings. The end thrust is carried upon ball thrust bearings supported on the end of the conical sleeve. This construction prevents the possible seizure of the spindle due to unequal expansion of the bronze and iron. The micrometer stop is located directly on the front of the spindle, this position having been found very convenient for setting operations. The stop and the slot in which it runs can be seen on the front of the spindle head. In working out the design of this machine the back gears are located on the upper part of the head directly under the spindle-driving pulley, and they are operated by a small lever projecting from the bottom of the bowl-shaped casting just beneath the spindle pulley. The feed-box is of the positive gear type. The feed is obtained from the lower drive shaft by a gear train to the feed-box. Eight feeds are obtained for each motor speed in geometrical progression, making it convenient to obtain any feed that may be most suitable for the particular job that is being done.



GENERAL VIEW OF THE MACHINE.

There are thirty-two feeds obtainable with a multi-speed motor and fifty-six feeds with the constant-speed motor, as follows: With an open belt, varying from 0.0024 to 0.0621 inch per spindle revolution, and with back-gears from 0.0126 to 0.3260 inch per spindle revolution.

There are fourteen spindle speeds obtainable when the power is supplied from lineshafting through the speed-box or from a constant-speed motor direct connected to the speed-box, varying from 73 to 438 revolutions per minute with open belt, and 14 to 83 revolutions per minute with back-gears. Eight spindle speeds are obtainable when the power is supplied by a multi-speed motor varying from 149 to 447 revolutions per minute with the open belt, and from 28 to 84 revolutions per minute with the back-gears.

The spindle is provided with a draw-bar and is stopped and started by a treadle at the left of the base, when constant speed is provided. The moving member of the clutches for engaging the power rapid traverse to the table is so made that it is impossible for both to be engaged at the same time. When motor drive is desired, the motor is placed on an extension of the base of the machine at the right side at the rear. A 7½-horsepower constant-speed motor running at 1,200 revolutions per minute, or a 7½-horsepower multi-speed motor with speeds of 600, 900, 1,200 and 1,800 revolutions per minute, or a 7½-horsepower variable-speed motor having a ratio of 3 to 1, is recommended. When either a multi-speed or a variable-speed motor is used, the speed-box is not necessary.

Extras, such as arbor supports, an oil-pump with connections, a rotary table with a circular top graduated to 360 degrees, having a working surface 30 inches in diameter and a draw-in chuck for holding cutters, can be furnished. Another important device is the cherrying attachment for die-sinking.

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PRINCIPAL CONTENTS

As We Were Saying

DURING the dying days of the year the daily newspapers devoted a large amount of space and a goodly number of scare heads to what they called a revolutionary discovery in the steel trade. This outbreak was based on cables received from correspondents in England, where the discovery was supposed to have been made, and nothing was left out that would tend to the embellishment of the reports. Briefly, they stated that Professor Arnold, of Sheffield, had discovered a new steel, called molybdenum, which would displace every other steel in the market. The British Government had placed an embargo on the patent, and were going to keep it for themselves alone, though according to the hopeful press writers, other nations were falling over themselves to get it.

In our issue of December 25th, under the heading "The Use of Molybdenum," we pointed out that molybdenum was not new, and its use in the manufacture of steel was not new. We gave a brief summary of the various alloys used in steel making, and their effects on the finished product, and pointed out that molybdenum possessed practically the same properties as tungsten, but less molybdenum was required for the same effect than would be necessary if tungsten were used. We suggested that Prof. Arnold's discovery lay in the direction of making molybdenum more amenable of application commercially than had been the case in the past. With the information we had at the time we could not say very much about the reliability of the claims set forth. Our experience is that the enthusiasm of the daily press on engineering matters is about equalled by their inaccuracy.

In the issue of "The Engineer" published on Jan. 2nd in London, we find confirmation of our views on the matter. Being on the spot, and in close touch with British steel activities, "The Engineer" is in a position to speak with authority on the subject. After remarking that if engineering were entrusted to the daily press it would increase in excitement if not in accuracy, they characterize the report as a wild story. The fact was that Prof. Arnold had during the war patented a tool steel that contained 6 per cent. molybdenum in place of the 15 to 18 per cent. tungsten generally used. Publication of the patent was suppressed precisely as all others were suppressed in war time, prevent the enemy obtaining particulars of it. When the news was released, the Sheffield steel trade didn't bat an eye. It is admitted that molybdenum has some slight advantages over tungsten, but as it costs three times as much as the latter, its superiority is not overwhelming. "The Engineer" thinks that in course of time molybdenum steel may win an important position in the market, but at present interest in it is chiefly from the scientific and not the practical point of view.

The steel trade seems to present many pitfalls for the unwary front page writer. It is not very long since that a Toronto daily published some wonderfully inaccurate descriptions of an electric furnace installation. We appreciate the fact that the front page has to be filled, but why not stick to the comparatively safe and indisputable stories of the sea serpent and dinosauria that were once so popular?

A Triumph in Projectiles

NEW developments have been made in bringing out a hard shell in Britain for the use of the navy. Sir Robert Hadfield makes the announcement: "The feat has been accomplished of getting the largest calibre of armor-piercing shell unbroken through the thickest of modern hard-faced armor plates."

Heretofore, the heaviest projectiles have been those used on the British monitors. The gun in which these were used probably weighs 150 tons, and when elevated to 45 degrees carries its projectiles 50,000 yards, or, say, thirty miles.

A writer in a British paper gives some idea of the penetrating power of these shells as follows:—

The shell, when capped and fired, and striking normally is capable of perforating armor of the following thicknesses, the shell itself emerging unbroken on the other side of the plate: (a) At point-blank range, no less than 41 in. of hard-faced armor. This is equivalent to a wall of unhardened steel of about 54 in.; (b) At 10 miles and 20 miles respectively, 22 in. and 12½ in. of hard-faced armor of the latest and best type. (c) Finally, at the extreme range of no less than 30 miles, armor of ordinary steel having a thickness of close upon 1 ft.

As a matter of fact, the shell in actual trials perforated a hard-faced plate of a thickness nearly equal to its calibre at a velocity equivalent to a range of about 14 miles. Thus the heaviest armor afloat, when attacked by it, would not be much better than a piece of cardboard.

The difficulty of hardening an armor-piercing shell of these dimensions will be readily understood, for suddenly "in the twinkling of an eye" a volume of something like 10,000 cubic inches of steel by quenching has to be converted from material of a Brinell ball hardness of only about 200 to one of between 600 and 700. To deal with the strains set up by the sudden change from what is almost material of plastic nature to one of extreme rigidity is indeed a difficult problem, as can be well imagined when it is stated that material of this high rigidity readily scratches glass. In addition, it must be borne in mind that the rupture strains which are set up by the sudden cooling mentioned may continue, not for hours, but for day, weeks or even months afterwards.

The following figures in regard to marine disasters are useful for reference:—The largest recorded loss of life in a marine disaster occurred when the Titanic was sunk, after colliding with an iceberg, south of Newfoundland on April 14, 1912, the list of deaths showing 1,503 names. The Lusitania, sunk by a German submarine, May 7, 1915, carried with her more than 1,200 of her passengers and crew. When the Empress of Ireland was sent to the bottom in the Gulf of St. Lawrence on May 30, 1914, the loss of life was 1,027. One thousand died when the Japanese steamer Kicker Maru sank in Australian waters on September 28, 1912.

Selling Steel Eight Months Ago and Now

By A. R. K.

SAY, it wasn't more than six or eight months ago that folks in the steel trade were coaxing their should-be customers to come into the ring and roll up a mill tonnage.

They had a good yarn to tell them, too, and they had it off word for word. The whole business of selling was being learned all over again. You know, during the war steel salesmen got soft. Their chests dropped down into their laps, and they got into the habit of wearing spats, morning coats and putting perfume on their handkerchiefs.

When it became known that a steel salesman was in town all he had to do was pick out the best invitation from the assortment of free dinners offered to him. He could have anything from "ham and—" to taking every known hurdle between soup and nuts.

But the end of the war knocked out his props and the steel salesman had to get out on the turf. There were double chins to be talked off—there were rotund figures to be machined, and there was, worst of all, a right-about from the days when the chief job was head liar and apologist for the firm.

Yes, Angus, these stall-fed, crate-stuffed tribe had to get out with a rail, a plate, a T-beam, a bundle of sheets, an assortment of bars, and sell the stuff. The open door policy was canned everywhere. They had to send in their little cardboard tickets once more and decorate the little bench where superintendents and purchasing agents make folks sit for awhile in order to justify their pay cheque. You know a superintendent or any other official who lets folks come right in and see him is going to fail. He ought to make 'em sit on that bench outside while he cleans his nails, reads the sporting page and does most everything except manicure his teeth and take a bath. Then the benchers are sure to murmur, "Busy guy," and sooner or later the office hears it—"Busy guy." Next thing you know that sup. has a raise in pay, a pretty stenographer with those grey suede hip boots, and he's sent off to souse in sulphur baths for an acute case of overwork.

He Had To Get Out and Sell.

We enjoyed them days when steel salesmen were out again pawing the turf and spoiling the pasture. We got on speakin' terms with quite a heap of them. Not a bad sort, either, but they don't love each other, no more than a man loves to own up that he's wearin' a wig.

They used to be grateful for information then. To tell a man where to sell a ten-foot beam was regular Damon and Pythias stuff. Then it was that we was all smokin' the same good five-cent cigars together.

But things has changed again. Steel salesmen have simply to go to the front door of a place and holler, "I told you so." You can't talk back. If you take his "Told you so" chant in good part the chances are that he'll shove your order up toward the top of the heap and slip you a couple of sheets or fifty pounds of plate on toward the end of the year.

The way steel men's swaggerin' round now sniffs of boiled shirt fronts, clean socks and diamond studs.

"Gentlemen, it's like this . . ."

There's a nice fat job open in one office where they spend time now wondering when production is going to be tripping on the heels of orders. That job is for some good, fat, juicy person, who owns a claw-hammer coat, a corduroy vest and who don't object to wearin' a sweet-scented geranium leaf in his buttonhole in working hours. He's got to be head prevaricator for the office, smooth as oil and as convincing as Lydia Pinkham in her palmiest days. His chief job is to wave his hand and speak thusly: "Now, gentlemen, it's just like this. It's perfectly true that that we booked your business, but one of the ingots that was to be rolled into your order got misplaced before it reached the rolls. Investigation shows that the head office boy got out a tracer for that ingot. He located the man who was on the heat the day it left the open-hearth. That man's number is 1628 in the south building. Evidence as to who witnessed the ingot that 1628 saw leave the open-hearth being stripped and soaked is missing. Our last report, No. 678,356, from the cost department, says this ingot must be some place between the open-hearth and the soaking pit. As soon as we receive a further report on report No. 678,356 we shall be pleased to take the matter up further with you." Here the head explainer is supposed to have one hand on the shoulder of the customer and with the other is presenting a perfectly good 1920 six-cylinder smoke.

If the customer shows signs of restlessness, or looks as though he might cancel the order, Claw-hammer is supposed to recite a couple of verses of Browning, discuss the farmers in politics, the nebular hypothesis, the brotherhood of man, the setting of slide valves, what to do with the surplus of smallpox scabs. If all these things fail, Claw-hammer is likely to lose his job.

If you've got a friend in the steel business now, cultivate him, especially if he has any shipments pointed his way. Ask him out to your house and have your wife take a snap-shot of you and the steel man lookin' at each other with a sort of "You know me, Al" atmosphere on your face. It's a quicker way to get popular in the community than havin' a booze shipment from Montreal delivered at your house in broad daylight.

MARKET DEVELOPMENTS

Mills Refusing to Take Further Business

Offices Here Report That Business is Now Being Turned Back on Them—Big Order of Small Tools Went at a Price to Old Country Firm—Sheets Head the Shortage List

NO good purpose can possibly be served by minimizing the seriousness of the situation that has come to pass in the iron and steel markets in Canada. Some of the largest offices are having their business turned back on them now by their mills in the States. Their deliveries are already extended away to the end of the year, and they reckon that further bookings would simply complicate matters to no good purpose.

The situation in blue annealed sheets is particularly serious. One report has it that a large maker of automobiles three or four months ago sent his representatives all through the country, and cleaned up on this stock, some of the stove-makers letting go to him, as they could make more money than by making their sheets up into stoves and selling them in the usual way. Whatever there may be to the story, it sounds reasonable, and it is a fact that the country is barren of these sheets now, and a number of concerns are pinched and cramped for material.

New base prices are reported for plate, bars, hoop steel, etc. In a number of cases many warehouses might as well quote any fantastic figure that appeals to them. They have not the material in their stocks, and they have no way of getting it.

The machinery market continues firm, with nothing to show that prices are going to be more reasonable. The sale of small tools and supplies is also reported as quite satisfactory. One order for 400 dozen high speed drills was placed in Toronto by one firm a few days ago. The bulk of the business was secured by an Old Country firm, which was able to put in a price that the Canadian firms would not come down to.

MONTREAL STEEL PRICES CERTAIN TO BE MOVED TO HIGHER LEVELS

Special to CANADIAN MACHINERY.

MONTREAL, January 29.—Combinations of circumstances are reaching the point where prices on steel commodities will require to be still further advanced. The reluctance on the part of producers to depart from the policy of avoiding radical price changes will readily be understood, as any drastic steps in this direction would probably mean a cycle of upward price quotations and labor demands, a condition that would not assist in settling the abnormal unrest that prevails throughout many industries at the present time. Dealers in this district report a steady and continued demand for all lines of steel products, but emphasize the acute situation that exists as regards the supplying of this demand. Despite the fact that the United States steel strike has been declared at an end, the production of the mills is apparently inadequate to meet the present trade requirements.

The cause of this falling off of mill output, it is claimed, is the inability to get sufficient raw materials in the shape of ores, fuel, etc., and inexperienced and efficient help to operate at the capacity which business on the books demand. The car shortage is one of the serious factors that influences mill production as shipments of material are very irregular. In addition to the present increasing demands for steel products it is thought that many developments in trade activity are being deferred on account of the high rate of exchange that must be considered when material is purchased from American mills. The exchange conditions have had the effect of increasing the demand on the Canadian mills, and additional activity in this direction is quite pronounced. The continued cold weather is taxing the railroads in the matter of traffic, and no small amount of the delays in transportation must be laid to this condition. While the market shows no immediate change in price quotations, the apparent perplexity of the entire situation will probably result in higher prices on many commodities. Local warehouses are practically bare of such material as is in general demand.

Steady Tone in Metals

The metal market has quieted down a little from the activity that prevailed last week, and the present tone is one of steadiness, with prices firm. The tin situation is still abnormal and is governed by conditions in London. Quotations may be shaded a little but the nominal price of 70 cents per pound is a fair basis of the prices asked by dealers.

Improvement in Tool Demand

The general belief is prevalent among dealers here that a steady improvement in the demand for machine tools will continue from now on. While there appears to be no pronounced buying from any one quarter, the disposal of equipment, both for tools and supplies, is spread over a wide area, not being confined to localized requirements. Many small machine shops throughout the country have been purchasers of single tools to augment their former equipment. There is little to indicate that the purchaser of a machine tool will be able to obtain the same at a lower cost than now effective for many months to come. As stated last week, some American manufacturers are showing their willingness to shoulder the extra exchange rate to stimulate the placing of orders, although in many instances early delivery is out of the question. Considerable activity is still reported in used equipment, and at good prices.

Steady but Quiet Demand

Little can be said of the old material situation other than that the market is decidedly firm on a quiet demand. There is a light but steady movement in all materials, with a slightly heavier demand for machine cast iron. The nominal prices quoted are subject to revision to suit individual sales.

NEW BASE PRICES ARE SHOWING ADVANCE

Shortage of Material is Cramping Industries—No Relief in Sight at Present

TORONTO.—One of the Toronto jobbers had before him a new price list for U. S. mills this morning. Summarized as to leading items they ran about like this:

Plate, base	3.50
Bars	3.25
Structurals	3.00
Cold Roll Strips	7.25

Roughly, that is an advance of about 90 cents per ton over prices that have been quoted since March 21 last. For some time past the premium business has asked almost any price that good delivery would warrant, but now it is an accepted thing, according to the reports this dealer had received, that these prices are current, and recognized as such.

As a matter of fact, if a person could place business now for plate at 3.50, and be certain of deliveries, he would not be taking much chance. He could make money on the business. Only today one dealer stated that if he could get 200 tons of plate at once he would be willing to pay 75 per cent. above market prices, and moreover he would thank the person who could lead him to the goods. .

No Improvement in Sight

It is quite right to state that the steel market is growing worse instead of showing signs of improvement. It may be all right for steel companies to show figures of production, to the effect that they are improving in their output, but the fact of the matter is that the man in Canada who wants to buy steel fails to see where these figures are helping him. His one chance to size up the whole situation is when he goes out to buy. If he can get deliveries he will believe that conditions are improving. If he cannot, it is hard to show him where the improvement comes in, and a good many people are in the latter class at the present moment.

There is some structural material to be had yet, perhaps more of this than anything else, and there is a certain tonnage of heavy plate that can be picked up. But blue and box annealed sheets are the worst off, and there are several shops in Ontario where the scarcity is being felt in a decided way.

Blames the Auto Industry

Here is the explanation that one dealer has to make of the blue annealed material: 'The automobile business is the direct cause of the shortage in blue annealed material. Some months ago they saw there was going to be a shortage in this line, and they knew it was necessary to their business that they should have a supply of this much in advance of what was to be secured in the open market. So they sent out their buyers and cleaned up everything in sight. Why, I know of cases where they went to makers of stoves and paid them a price for their stocks of blue annealed material that would represent a better turnover than if they had made the material into stoves and sold them out to the trade in the usual way. It was a short-sighted piece of business for the stove makers who sold out at that time, for they find now that they cannot get anything more of this line."

POINTS IN WEEK'S MARKETING NOTES

Pittsburgh advices state that the anxiety of buyers to be protected for nearly all lines of steel and iron is becoming more pronounced each week.

Advices this week give 3.50 as the current base price on plate at Pittsburgh and other points. The war price was 3.25.

Local dealers state that principals are turning down nearly all the business they are forwarding to them now in lines of steel.

Dealers in small tools report business as being good and coming from a well-distributed lot of sources.

One order for small tools in the Toronto field was for 400 dozen drills. It went to an English company by reason of a close price.

Belief is expressed that there may be a runaway market in steel if the companies do not get together. The anti-combine law makes it hard for them to come to any agreement.

Machinery Markets

Although there has not been any very great buying going on, inquiries continue to come in from a well-distributed area. Deliveries are not making any improvement, but there are some firms that are doing better than they promise when the business is placed. It is a matter of satisfaction to the dealer who holds such agencies, as a betterment in a delivery date is a much better factor in securing business than the making of apologies for falling down in the matter.

One Toronto buyer recently returned from making the rounds of the U. S. shops. He reports that production of machines is not as good as before the war. There is a complaint in the shops that the per-man production is down and against that they are paying a much higher wage. The prediction was freely made in several places that the top of the price list had not yet been reached.

The Small Tool Section

Prices remain firm in the small tool and supply market. Reference was made a few issues ago to a large order that was likely to be placed in this district. The business went to an English firm, and was for 400 dozen drills of various sizes. Canadian dealers quoted on the deal, but they refused to give the concessions that were necessary to meet the competition of the Old Country firm, and it is understood that the bulk of the order was placed at a price about ten per cent. below the prevailing market quotations.

Canadian dealers are being called upon now for the first time in some years to meet Old Country competition.

Business in the small tool section is reported as brisk by all the dealers. There is no tendency to shade prices now, and this condition seems to be working out in a very satisfactory way all around.

Prices May Move Up

There are indications that pig iron prices may move beyond their present levels for the last half of 1920. Present quotations in Toronto are about as follows from Canadian stocks:

No. 1 Foundry (silicon 2.25 to 2.75 per cent.)	$47.30
No. 2 Foundry (silicon 1.75 to 2.25 per cent.)	45.95
Standard malleable	47.30

By basing on present Buffalo prices and prices for last half deliveries, it would not be surprising were prices for this district to be:

No. 1 Foundry	$49.45
No. 2 Foundry	48.10
Standard malleable	41.25

LACK OF STABILIZING INFLUENCE MAY BRING RUNAWAY STEEL MARKET

Special to CANADIAN MACHINERY.

PITTSBURGH, Jan. 27.—There is a contrast between the increased anxiety of buyers of pig iron and steel to cover their requirements with price a secondary consideration, and the growing fears of financiers that fundamental conditions are unsound and will grow worse until what they consider a wave of extravagance is checked, either by intelligent and co-operative action in advance or by the stern mandates of economic laws transgressed.

All the evidences of the pig iron and steel markets are of increased strength. Consumers are anxious to buy, to secure protection on their raw materials farther ahead. They are not only willing to pay advanced prices if asked, but are actually bidding prices to producers in hopes of inducing them to loosen up in their sales policies. The producers claim to be conservative and to be desirous of avoiding a runaway market, but it seems rather clear that their refraining so largely from selling is stimulating buyers to put the market up on themselves.

Steel Price Situation

Briefly reviewed, the situation as to

sales of finished steel products is that the United States Steel Corporation has sold at the March 21 or Industrial Board prices for about six months ahead, while few of the independents have sold much tonnage beyond the present quarter. A part of this tonnage sold has been at stiff premiums over the March 21 schedule, but another and considerable part has been at those prices. Thus while the independents do not have nearly as much tonnage on their books at the March 21 prices as has the Steel Corporation, still they do have a considerable tonnage. Some of the independents that have sold only at March 21 prices have made promises to regular customers that they will take care of their tonnages for second quarter, but at prices to be named later, on one date or another in March.

In view of the great pressure for steel products on the part of manufacturing consumers, who see excellent trade ahead of them not only for second quarter, but for a longer time, the steel ought to have been sold to them before this. The reason it has not been sold, except in the case of the Steel Corporation, is that the trade has virtually been without its old time Steel Corporation leadership. The independents used to follow that leadership, but of late they have been, with few exceptions, and now probably with none, unwilling to follow that leadership because it means March 21 steel prices and the independents want more. The independents, however, are unable, on account of the laws, to get together and decide what they do want, hence they have drifted along and buyers become more nervous each day.

A prediction, which seems a pretty fair one in the circumstances, now made is that the independents without any particular collusion will advance to the prices ruling before the March 21 or Industrial Board reductions, which would put the market on the basis obtaining after the first reductions were made from the war control prices. These reductions became effective December 12, 1918, ranging from $4 a net ton on structural shapes and merchant bars to $8 on tin plate, but with no reduction on wire products. The March 21, 1919, reductions were $5 a net ton on wire and wire products and on grooved steel skelp, with $7 on practically all other finished steel products.

Another prediction is that the market will go up to the war control level, passing over both reductions instead of only one. This prediction is not as popular as the other. In each case, however, the talk is that the large independents would stick to the advanced level, once attained, so as to avoid a runaway. A third prediction is that there will be a general runaway, in which case the Steel Corporation would either abandon its policy and follow the runaway or would be in the position of furnishing its steel to regular customers, as far as the production would stretch, at much less prices than the customers could buy at elsewhere.

The case of the smaller independents is not included in the first two predictions. The smaller mills have a way at all times of not selling far ahead, cutting the general market when it is weak, and securing delivery premiums when it is strong and the large mills are sold up several months ahead. Thus there might conceivably be three markets, one on the part of the Steel Corporation at March 21 prices, another on the part of the larger independents at January, 1919, or war-control prices, and still another at a wide range of premium prices for particularly early deliveries.

Demand Prospects

The common view is that there will be an unlimited demand for steel for several quarters to come, i.e., a demand clearly in excess of the supply, whatever that may be. Unquestionably this conclusion is premature, and the fact that it is so almost universally held does not confirm the view but rather makes it the part of wisdom not to accept it as a finality. Those who hold the view, when questioned, are found to hold it either because they find everybody else holds it, for no better reason than they themselves, or hold it because they find buyers so importunate in seeking to buy. As to this phase, the condition may be due to the extreme reserve of the independents in selling, due to their having renounced Steel Corporation leadership and thus being without leadership, and the necessary reserve of the Steel Corporation because it will not sell more than it can produce and must apportion that tonnage to regular customers.

If the prospective demand for steel be scrutinized from the viewpoint of prospective consumption operations rather than from the viewpoint of the importunities of buyers—which may be only a sort of "hearsay" evidence—the prospects for large consumption are found to be not necessarily so clear. Much is being said about large purchases the railroad companies are going to make after their lines are returned to them March 1, but railroad officials do not talk that way. They express concern as to where they are to get money, and money first for refunding maturing obligations, not for making additional expenditures. As to new construction, of buildings, factories, bridges, etc., into which normally a large proportion of the steel output flows, there is complaint everywhere of labor being very scarce and of construction costs being extremely high. There will undoubtedly be altogether as much building of one sort or another as there is labor supply but there is no distinct outlook of there being a great volume of building of the character that consumes large quantities of steel. For illustration, offices are extremely scarce in Pittsburgh and a few days ago B. F. Jones, Jr., bought the Monongahela House, a large brick building erected 80 years ago and for several decades the leading hostelry in Pittsburgh. There is no thought of rebuilding, however, the intention being simply to convert the old hotel into office rooms. Again, it is just announced that the Mellon Bank, which years ago acquired the various parcels of real estate making up what is one of the very best sites in Pittsburgh, facing three good streets, is about to go ahead with its building project, but it is understood it will erect simply a three-storey bank building, not a sky-scraper, even though space in office buildings is renting at 50 to 100 per cent. above the rates of five years ago.

The common view may be right, but this is a time when the majority may be wrong, and the individual will do well to consult also his own judgment.

U.S. SCRAP METAL

There has been a strong market for scrap material, heavy melting steel selling particularly well. Total sales of this grade were over 50,000 tons. Following are reports from various U. S. centres:

PHILADELPHIA.—Steel scrap sold in large quantities at $25 delivered, the largest buyers being the Bethlehem Steel Co. and the Lukens Steel Co. There is a good demand for all grades of scrap material, cast scrap being most in demand.

NEW YORK. — There has been an active market here, and prices have advanced. Heavy melting steel has been the most in favor, sales amounting to over 70,000 tons. The price of this material is $20.50 to $21, f.o.b. New York. Heavy cast scrap has advanced about $1.

PITTSBURGH.—Heavy melting steel is being quoted pretty generally at $28, and a small tonnage has been sold at this figure. The market for steel making grades is very strong. A small lot of baled sheet scrap was sold at $24, and bundled sheets have brought $20.

BUFFALO.—There is a strong market here, with good enquiries for all grades of material. Enquiries for heavy melting steel aggregate 25,000 tons. Heavy melting remains around $25 to $26, although $27 has been asked by Youngstown for delivery to this district.

CLEVELAND.—While both cast scrap and heavy melting are strong, cast scrap has taken the lead. Heavy melting has advanced to $26 and $27, while No. 1 cast has sold as high as $38 per gross ton, and heavy cast $26. Other grades are about the same prices as last week.

CHICAGO.—Cast scrap is in strong demand by foundries, and is generally quoted at $42.50 per gross ton. Steel grades have declined somewhat, due to short selling by dealers. There is very little chance of any general reduction.

ST. LOUIS.—Good demand with heavy buying, caused an advance in most grades of scrap material during the week. Railroad wrought is now quoted at $28 to $28.50, iron rails at $30 to $30.50 and care wheels $33.50 to $34. The Lacled Steel Co. bought 10,000 tons of re-rolling rails.

CINCINNATI. — There is a strong market, with plenty of enquiries, but not a great deal of actual business. There is not much material held in stock, and this is not increasing.

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The History and Manufacture of the Telephone

When You Use the Telephone, Do You Realize the Work Entailed in Its Manufacture? The Fundamental Principle of Telephony, With the Manufacture of the Conductors, Etc., Are Explained

By G. C. BROWN*

THE telephone has become so available and its use is so habitual with the majority of us, that we accept it as a necessary part of our daily scheme pretty much without comment, forgetful of the fact that our great grandparents did not know the blessing of a telephone and transmitted their communications either by means of messengers or through the medium of letters written in longhand. Whenever we speak into our office or home telephones and hear the reply coming back from a distance of one hundred or a thousand miles, a marvel is enacted before us, which makes all previous accomplishment in the field of communication look small and ridiculous. In the year 490 B. C., a Greek runner carried to Athens the momentous tidings of the victory of the Greek General Miltiades over Darius and his Persian host on the field of Marathon. The athlete completed the distance of twenty-six miles in something over two hours, delivered his glad tidings and then fell dead. If Miltiades had possessed a field telephone connecting the Grecian camp with Athens, he could have communicated the news of his victory in two minutes and the runner's life would not have been sacrificed. Comparisons of this nature bring home to us something of the debt that we owe, both to the man who invented the telephone and to those who during the past forty years have labored to improve it.

It is just forty-three years since Alexander Graham Bell exhibited his telephone at the Philadelphia Exposition of 1876. The telephone of to-day does not greatly resemble this first working model which was a crude affair that would barely transmit speech over short distances. A succession of developments, following each other with bewildering rapidity, have given us first long distance or toll lines, next the automatic telephone and as a final triumph, the wireless telephone.

While this rapid development has brought untold benefit to our twentieth

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FIG. 1—MAIN FACTORY AND GENERAL OFFICES. NORTHERN ELECTRIC COMPANY, LIMITED, MONTREAL.

century civilization, it has carried with it the disadvantage that time has not been provided for the preparation of standard text books on telephone manufacture. In other fields of scientific development, notably the application of steam and electric power to industry, there have been periods of quiescence or breathing spaces during which a comprehensive literature has been created and kept reasonably up-to-date. The history of the telephone, since its inception, has been one of constant change and manufacturing practice has had to undergo a corresponding process of continual readjustment. A number of excellent books on the telephone have been published. These, however, are devoted chiefly to elucidation of the principles underlying telephony and to the design of the telephone and its auxiliary equipment. Problems of manufacture are either not touched upon, or at best are dealt with in a perfunctory manner.

In order to successfully manufacture telephones from day to day, peculiar problems in almost all branches of applied science and economics have had to be attacked and solved, and to this list, which I will not trouble to enumerate, have recently been added problems in Sociology and Vocational Training.

Fundamental Principle of Telephony

In order that the various steps in telephone manufacture shall be properly comprehended, it is desirable that we dwell briefly on the fundamental principle which makes the telephone possible, and also on the "modus operandi" of a telephone system. The telephone in its most elementary form includes two units, each consisting of a transmitter and a receiver, situated apart, and interconnected by means of two electric wires into which a delicate electric current is automatically switched when the receiver is raised from its hook. The transmitter or "speaking" part contains a circular metal diaphragm,, sufficiently thin, and so placed that it will vibrate under the influence of the human voice. In the transmitter the current must pass through a small box of granulated carbon before reaching the line wire, the transmitting diaphragm forming the outer or "mouthpiece" side of this box. When the transmitting diaphragm vibrates under the influence of sound, it controls the current passing through the carbon and into the line. The receiving or "listening" part of the telephone contains a permanent magnet with both its poles in close proximity to a circular metal disc similar to that in the transmitter. The fundamental priciple of the telephone consists of the control of the delicate electric current in the line by means of the vibrating transmitter-diaphragm, the variations in current thus produced passing over the line and into the magnet of the distant receiver. The energising effect produced on this magnet sets up sympathetic vibrations in the receiver diaphragm, which when held to the listener's ear, reproduces the sound or sounds registered into the distant transmitter.

This simple description applies to a condition where communication is provided between two telephones only. In a telephone system, however, there are many hundreds of telephones, all of which must be interconnectable. This difficulty is solved by bringing all the telephone wires into one central exchange and having them terminate at a switchboard, a socket in the board marking the terminus of each line. An operator in the central office or exchange is now able to temporarily interconnect any two sockets by means of flexible interconnected wires or, as they are termed, "cords," each equipped at one end with a metal plug. By placing one of these plugs into the socket corresponding to one telephone line and a second plug into another socket, both phones become directly connected to each other and communication is established. This provides for the connection of any two lines on the switchboard, but does not provide a connection between the exchange operator and the distant telephone which is seeking a connection. It has, therefore, been found convenient to have additional sockets placed in front of the operator, and to carry branch lines from her main line to these sockets which are termed "answering jacks." One of these "answerin jacks" is, therefore, provided for each telephone connected with the exchange.

In order that the exchange operator may know when one of her subscriber wishes to speak to her, a miniature electric lamp is placed beside each "answering jack." This lamp is automatically switched on when the calling subscriber raises the receiver from its hook, and when "Central" has made the desired connection, it is automatically switched off. The switchboard alsc has "ringer" keys and the operator by depressing one of these keys, which are situated in front of her, can ring any subscriber's telephone, and in this way signal the fact that connection is established with another subscriber. The term "subscriber" by the way covers anyone who has rented telephone service from the Telephone Company and is, therefore, connected up to an exchange.

The conductors which serve as the carrying medium in a telephone system, naturally constitute a very important part of the system. Under the heading of "Conductor" are included, first — the large telephone cables, either underground or aerial, which are used in congested area, or for long distance transmission between cities, or for connecting up exchanges. The chief advantage following the use of a cable lies in the fact that is compact, and serves as a container for a considerable number of telephone circuits or individual lines. Telephone cables are made up of annealed copper wires, each wire insulated with spiral wraps of paper. Two of these conductors are then twisted together to form a "pair." The required number of pairs are then stranded into the form of a cable and covered with paper wrapping. This cable or "cable core" as it is termed at this stage, is next dried, and as a final operation, is covered with a protective metal covering or "sheath," consisting of an alloy of either lead and antimony or lead and tin. These steps

FIG. 2—DRAWING WIRE OR WIRE-DRAWING MACHINES.

FIG. 3—FIVE HEAD TELEPHONE INSULATOR MACHINE USED FOR PAPER INSULATING TELEPHONE CONDUCTORS

in cable manufacture will be dealt with in more detail later on.

Under the heading of "Conductors" are included next the various feeder or distributing wires, so termed because they serve to distribute telephone service from the larger cables to public or private buildings. These wires are used between poles and houses, and at the house entrance connect into other conductors known as inside wires. Both of these forms of conductor are insulated with rubber, over which is braided one or more layers of cotton, and if the conductor is to be exposed to the outside weather, it is impregnated with a weatherproof compound which serves to greatly increase the durability of the insulated covering.

Next we have the switchboard wires which, as the name suggests, are used in the wiring of telephone switchboards at the exchanges, then the distributing frame or "jumper wires," which provide a connecting link between telephone cable and switchboard; then the flexible cords used in making the switchboard plug connections, and which are also used as the local connection between telephone and ringer; and lastly, the fine silk or cotton covered magnet wires used for winding about relays, induction coils, etc.

FIG. 6—TWO ROWS OF NEW ENGLAND BUTT BRAIDERS. EXTERNAL BRAIDING SILK AND GLAZED COTTON ON FLEXIBLE CORDS

Manufacture of Conductors and Telephone Apparatus Conducted Separately

In order that telephone service be brought within the reach of humanity, therefore, it is necessary to manufacture:

First—Telephone conductors, including cables, telephone wires, magnet wire, switchboard wire and cable, distributing frame wire and flexible cords.

Second—Telephone apparatus, including the assembled switchboard, distributing frames, receivers, transmitters, signalling apparatus, etc.

I have placed the conductor first, because the assembly of numerous pieces of telephone apparatus pre-supposes the existence of various forms of conductor. Induction coils for instance must be wound with magnet wire before they can be assembled into telephone apparatus. The switchboard, before it can be assembled in permanent form, must have the necessary switchboard wires, distributing frame wires and flexible cords. The manufacture of the conductor in a certain sense precedes the manufacture of the telephone apparatus.

Until quite recently it has been considered desirable to manufacture conductors and telephone apparatus through separate organizations, chiefly owing to the fact that from the production standpoint there are marked points of dissimilarity between the problems involved. The building up of a telephone cable, for instance, is a synthetic operation in which, starting with a copper wire base, something is added at every stage until, at the end of the last stage, we have the finished cable. This same idea applies to the manufacture of all conductors. The types of machines used, moreover, are peculiar to that class of work, and in many cases have been developed to perform a definite operation. Under this heading are included insulators, twisters, standers, etc. The manufacture of telephone apparatus is characterized by a constant flow of small parts towards a final assembly, the machines used being largely the conventional type found in all factories, lathes, screw machines, punch presses, etc.

While practice has until very recently kept the manufacture of conductors and the manufacture of telephone apparatus distinct, the manufacturing operations for the two classes of work being performed through separate organizations and in separate factories, this is in process of change, and the entire manufacture of the telephone is gradually being brought under one functional organization. In outlining the manufacturing operations, however, we will observe the division mentioned, and will proceed, first, with a brief description of the operations incidental to the manufacture of cables, wires and cords, as performed

FIG. 4—LARGE TELEPHONE STRANDER SHOWN STRANDING UP A TELEPHONE CABLE.

FIG. 5—THIRTY-INCH LEAD PRESS AND MELTING KETTLE. TELEPHONE CABLE CORE BEING COVERED WITH LEAD

in the Shearer Street factory of the Northern Electric Company.

The Manufacture of a Telephone Cable. Wire Drawing

The first stage in the manufacture of a telephone conductor consists of drawing the copper wire to the desired gauge, wire for use in telephone cables being in most cases drawn to a finished diameter of either Nos. 19 B & S or 22 B & S gauge (.036 in. and .025 in. respectively). The drawing of copper wire is rendered possible through the property possessed by that metal of permanent extensibility with a corresponding reduction in cross-sectional diameter, when a rod rolled from a copper ingot is pulled through a die, or a number of dies, the inside diameter of which corresponds to the diameter of wire desired. The wire-drawing operations are performed on various types of machines, the details of these varying in accordance with the fineness of gauge required in the product. All wire-drawing machines, however, fall into one of two general classes depending on whether one die, or more than one die is used in a single drawing operation or "pass." These two classes are:

(a) Single Block Machines.—When one die is used, effecting a single reduction in the diameter of the wire.

(b) Continuous Machines.—When a number of dies, effecting simultaneously a series of reductions are used.

All telephone conductors are drawn on continuous machines, and magnet wire as small as No. 40 B & S gauge (about the same diameter as a human hair) is produced daily. The die used in wire drawing may be a piece of chilled iron, or for finishing gauge it may be a diamond or a ruby. The object of utilizing precious stones is to enable the dies to be used for a considerable time without losing their size and so producing wire of incorrect diameter.

The mechanical action or wire-drawing has the effect of hardening the wire, this rendering it unworkable, and also impairing its electrical properties. It must therefore be annealed at intervals during the progress of drawing. The annealing operation at the Northern Electric Co. is accomplished in large gas-fired furnaces served by two gas producers.

Fig. No. II shows one of the Northern Electric Company's continuous wire-drawing machines.

Insulating and Twisting

If the wire is to be used in the manufacture of lead-covered cables, it must, after having been drawn to the correct gauge, be insulated with a wrapping of paper. This operation is accomplished on high-speed insulators, the paper being spiralled about the wire, which travels through the machine at a high rate of speed and in finally wound about iron reels known as "take-up reels." Each insulator is equipped with five insulating heads arranged in such a way that five parallel wires pass through simultaneously. A girl attends to all five heads as shown in Fig. III.

The insulated wires are next twisted into pairs, this operation being performed on high-speed twisters. The twisted pair obtained at this stage provides a single telephone circuit. The twister heads, sometimes termed "fliers," turn at a speed of 500 r.p.m., the twisted wire being taken up on large metal take-up reels in readiness for the operation of stranding which follows next in the sequence.

Stranding

From the high speed twisters we have an accumulation of reels of insulated and twisted pairs, each pair a distinct telephone line. These twisted conductors must be bundled into the compact form of a cable, and as a cable frequently contains as many as nine hundred telephone lines, the bundling or stranding machine must be somewhat elephantine in design.

By referring to Fig IV, showing one of the Northern Electric Company's large telephone stranders, two outstanding features will be observed. First, that a strander occupies considerable longitudinal floor space, and second, that the reels of twisted pairs are loaded upon it in a cluster-like arrangement throughout its entire length. A telephone strander consists of a number of hollow cylindrical sections, known as strander drums, each section accommodating a certain number of reels of twisted pairs, and as a cable during the progress of stranding is increasing in diameter throughout its length, the capacity of each strander drum for these reels is successively greater than the one before it.

When the reels are in position on their respective shafts, the end of each twisted conductor is threaded through an eyelet, all the conductors converging then towards a central die, one of the latter being in place before each strander drum. The various drums are then placed in operation and revolving in alternately opposite directions, bundle the cable into compact spiral layers. As the stranded cable emerges from the last strander drum, a layer of cable paper is wrapped about it in regular convolutions, the cable at this stage being known as a "cable core." (It does not, by the way, attain the full dignity of a finished cable until lead covered. The cable core is finally taken up on a vertical drum mounted on a truck termed a "core truck," and when the latter is full, it is removed from its position in front of the strander and an empty core truck substituted.

Testing for "Crosses" and "Opens"

It frequently happens that the paper insulation about individual conductors is not continuous and that through some accidental circumstances there is at some point in a length of stranded cable an uninsulated or "bare" spot. If two of these bare spots occurring in adjacent conductors are squeezed into contact with each other, the resulting condition is termed a "cross." It frequently happens, also, that, owing to the necessary tension on conductors during stranding, one or more of these are broken, the cable under these circumstances emerging from the strander with certain conductors not continuous. This second condition is known as an "open." If a cable containing either of these defects were permitted to leave the factory and be placed in service, the result would be a short circuit through the crossed conductors, and no circuit through the open ones. It is very important, therefore, that all telephone cables be carefully tested for these faults, and this test is conducted immediately after stranding by connecting the pairs one by one with an electric bell or buzzer, and ringing them out. If a cross or an open is found through the failure of certain pairs to ring out in a satisfactory manner, the exact location of the defect must be established, this being accomplished by means of a Wheatstone bridge. When the faults have been located, the paper wrapping is removed from the cable at this point and if the fault is a cross, the conductors are properly insulated apart; if an open, they are brazed together.

FIG. 7—BENCH WORK ON FLEXIBLE CORDS. GIRLS BINDING ENDS OF CORDS AND SOLDERING METAL CONNECTIONS INTO PLACE.

Drying the Cable Core

The next operation is that of drying

or desiccating the cable core in order to expel all moisture. The loaded core trucks are now wheeled to large steam-heated drying ovens, where the cable is exposed to a drying heat for a period ranging from twenty-one to forty-two hours, this period governed by the size (number of pairs of the cable).

The elimination of moisture from a cable by drying has the effect of greatly increasing the transmission efficiency of its component pairs by controlling two electrical properties known technically as "electrostatic capacity" and "insulation resistance." The electrostatic capacity of a dried cable is low and uniform, while its insulation resistance is very much higher than that of an undried cable. Moisture, while not a good conductor of electricity, is nevertheless a conductor, and if permitted to remain would cause a condition similar, in a sense, to the fault described as a "cross," thus creating local interference throughout the cable when placed in service.

Lead Covering

After drying, the cable core is covered with a protective lead pipe or sheath, the thickness of which varies from 1-32 to ¼ of an inch, depending on the diameter of the cable core. The core truck with its load of cable core is transferred, after the drying operation, to another oven situated behind a large hydraulic press, the latter equipped with a hollow core-tube and forming die, and driven by a multi-speed pump. Immediately above the assembly of core-tube and die is placed a lead cylinder or container into which molten cable sheath alloy, consisting of lead plus a small percentage of either antimony or tin, is run from an independent melting kettle. The lead cylinder is first charged with molten alloy, and the charge permitted to cool to plasticity. The hydraulic press is then placed in operation and forcing the plastic alloy into contact with a vertical ram, squeezes it out between the core tube and forming die, at which point it comes in contact with the cable core, the end of which has previously been thrust into the hollow part of the core tube. The cable sheath thus forced through the die, grips the cable core and carries it along, the lead-covered cable as it emerges from the press being reeled up on large wooden cable reels.

The operation of a lead press requires considerable skill on the part of the workmen employed, as the cable sheath must be perfectly concentric throughout its length. The usual gang consists of an operator, who attends to the running of the press, and a helper who attends to the charging of the melting kettle and press cylinder and also sees that the cable is being properly reeled up on the take-up reel.

A sense of proportion in regard to this operation will be gained by glancing at Fig. V. which shows a 30-inch lead press extruding cable sheath.

The cable, from the manufacturing standpoint, is now complete, and passes next to a rigid final inspection. If it comes through this ordeal in a satisfactory manner, it is pronounced fit for shipment and is encased on the cable reel by means of wooden lags, after which the reel is transferred to the shipping platform.

The Manufacture of Rubber-Covered Telephone Wires

The distributing wires or "feeder" lines which form the connection between poles and house entrances and the inside wire running from the house entrance to the telephone, have no protective lead covering as in the case of large underground cables. In order that the individual conductors shall be properly insulated apart and moisture-proof, it is necessary that they be rubber covered. The Northern Electric Company therefore maintains complete equipment for the compounding and manufacture of rubber, and also machines for encasing the conductor in its rubber covering. Two types of machine perform the latter operation. One, a "strip insulator," equipped with a grooved die, which presses longitudinal strips of rubber about the conductor. The other, a "tube insulator," which extrudes the rubber through a core and die in much the same way that a lead press extrudes the metal sheath about a cable core.

The manufacture of the rubber used for insulating purposes is in itself a veritable science, and gives rise to many special problems. The rubber is received in crude form from forests and plantations in the tropics, and must undergo a cycle of preparatory operations before it can be used for insulating purposes. First it must be washed for the removal of foreign matter. Next it is hung up in long strips and subjected to a slow drying process. Then it is mixed or compounded with other materials which are added in various proportions, in order that the final compound will possess the proper physical characteristics. One of the most important materials used in compounding is sulphur, the vulcanizing constituent of all rubber compounds, which, when added, tends, under the influence of heat, or as it is termed "a cure," to interact chemically with the rubber and greatly increase its physical strength.

If the rubber is to be used for strip insulating purposes, it passes, after mixing, to calender rolls, where it is pressed into thin sheets, which are cut into strips of a suitable width for the strip insulator. If it is required for tube insulating purposes, it is rolled into heavier sheets, which are then cut into thick strips and fed into the forming die of the tube-insulating machine.

In order that sulphur in the rubber compound will not interact chemically with the copper conductor, the latter after wire-drawing, and before insulating, is coated with tin, by passing it through a molten bath of that metal. After the conductor has been strip or tube insulated, it is subjected to a steam or a dry cure, the nature and effect of which have been referred to. It then passes to a braiding machine, and is covered with an external braid of cotton, through which is run a thread of another color known as a "tracer" and used for identification purposes.

Figure No. III shows a double row of braiders working on flexible cords. It will be observed that the braider consists of a horizontal table, with individual vertical spindles or "carriers" provided for each spool of cotton or silk, and that the wire passes vertically from a give-up reel into the machine, receives its braid, passes about an overhead capstan, and finally down to a take-up reel situated near the floor. Interesting details in the construction of a braider consist, first, of a mechanism whereby the braider automatically stops if a single thread breaks while it is in operation; and next, the

FIG. 8—MULTIPLE SWITCHBOARD IN A CENTRAL EXCHANGE.

fact that two or three distinct layers of braided insulation can be simultaneously braided by using a braider with double or triple decks of carriers. On certain types of wire, one girl can, without difficulty, operate as many as forty-five of these machines.

After braiding, the conductor is impregnated in dielectric or weather-proof compounds and is polished mechanically. Two wires are then twisted together to form a pair. A careful inspection follows, after which the twisted pair is coiled into the desired length, the coil is tied with tape and finally wrapped with paper or packed in boxes ready for shipment.

Telephone and Switchboard Cords, Magnet Wire and Switchboard Wire and Cable

The green telephone cord, a familiar part of our office or home telephone equipment, and the switchboard cord, which enables the exchange operator to make her myriad of daily connections, differ from the forms of conductor which we have hitherto considered, in that the conducting element of a cord is not a solid copper wire, as in the previous cases of telephone cable and rubber covered wire. It is obvious that the most important characteristic of a cord in service must be perfect flexibility combined with sufficient durability. Tinsel threads are therefore twisted together, and these instead of a solid copper wire form the conductor. Each cord consists of two or more conductors, insulated, apart and covered with an external braid of either cotton or silk, the finished cord having at either end the necessary terminals or connectors.

As many styles of cord are manufactured, the following list of operations on a switchboard cord can be regarded as typical of all cords, the greatest number of operations incidental to the manufacture of any cord being included:

I.—Insulating the tinsel conductor with two lappings of silk.

II.—Impregnating the insulated conductor with a moisture-proof compound.

III.—Braiding the impregnated conductor with soft cotton. One thread of a distinctive color being used as a 'tracer" for identification purposes.

IV.—Twisting two or more conductors together with a filler of twine to render the cord round.

V.—Cutting the twisted conductors to the proper length.

VI.—Unravelling the cord at switch and plug ends.

VII.—Binding the conductors with cotton and wire at switch ends.

VIII.—Binding the conductors with silk, cotton and wire at plug ends, also forming ends of conductors to fit plug.

IX.—Braiding reinforcements of soft and glazed cotton wherever required on cord. External braiding of entire cord.

X.—Soldering connectors on plug and switch ends of cord.

XI.—Waxing cord at plug end. (In wax tank).

XII.—Inspection of finished cord.

Figure VII shows the manner in which the binding and soldering operations are performed on telephone and switchboard cords by girls working at benches. Soldering is accomplished by means of electric soldering irons.

The manufacture of magnet wire is less complex than the processes which we have been describing, as fewer component operations are involved. The incidental operations, however, require the exercise of great skill and care owing to the extreme fineness of the work. Magnet wire is frequently as small as No. 40 B. & S. gauge (.0031 in.), and as its insulation must be spiralled on perfectly even by an insulator running at a very high rate of speed, the operation is necessarily a delicate one. The girl operators, in time, develop a high degree of skill in detecting the presence of skips or knots in the insulation as the wire passes through, and promptly shut off the heads in order to repair the trouble. A skilled magnet wire operator is said to possess "a touch" which signifies that by running her fingers lightly and deftly over the moving wire she can find flaws in insulation which would probably escape her if she depended wholly on sense of sight.

The copper conductor used in the manufacture of magnet wire must have high electrical conductivity and be thoroughly annealed. Only the highest grades of cotton or silk can be used, the Northern Electric Company using for this purpose a soft, even cotton known as "Sea Island" cotton, and a high grade of silk called "Italian Tram." The insulating machine is similar in principle to the five-head telephone insulator shown in Fig. III, with marked differences, however, in details of design and using an entirely different insulating material.

Magnet wire is manufactured in either round, flat or square form and is insulated with either cotton, silk, asbestos or combinations of these materials as required. Before being sent out of the factory on wooden spools, it receives a careful inspection.

Switchboard cables, each containing a number of conductors insulated with servings of silk and cotton, stranded into the form of a core and covered with either an external flame-proof braid or a protective lead sheath, constitute the main feeders in central exchanges. The conductors may be stranded in singles, pairs or threes, the cores being covered by one of three methods outlined in the "Northern Electric Handbook" as follows:

First Method: Dry Core—Layer of paper tape, layer of lead tape, layer of paper tape, an external flame-proof braid.

Second Method: Impregnated Core—Two layers of paper tape, an external flame-proof braid.

Third Method: Dry or Impregnated Core—Two layers of paper tape, a protective lead sheath.

Switchboard wire, as implied by its name, is used for interior wiring in cen-

FIG. 9—GIRLS WINDING INDUCTION COILS, RELAYS, RECEIVER MAGNETS, ETC.

FIG. 10—ELECTRO PLATING BATHS USED IN NICKLE PLATING TELEPHONE APPARATUS.

tral exchanges and is manufactured in the form of single conductors or twisted pairs. The individual conductors are of annealed, tinned copper insulated with servings of silk, covered with an external cotton braid and finally impregnated with a moisture-proof compound. Switchboard wire for use under special conditions, receives a coat of enamel before insulating, this being a recent manufacturing development.

Distributing Frame Wire

The last type of conductor which we will consider is distributing frame, or as it is more commonly known, "Jumper" Wire. This conductor forms the connecting link between the large telephone cables, at the exchange, and the more local switchboard cables, every large exchange having beneath the switchboard floor a complicated arrangement of these interconnections. Distributing frame wire is rubber insulated in a manner similar to rubber covered telephone wire and is afterwards braided and saturated with flame-proof compound.

The Manufacture of Telephone Apparatus

The production of telephone apparatus has already been described as a continuous flow of countless component parts or "piece parts," through a succession of manufacturing operations towards a final assembly, from which latter stage emerges a piece of assembled apparatus containing, perhaps, thousands of the original piece parts. The term piece part, incidentally, is applied to any component which is not complete in itself, but which must be assembled with one or more other piece parts, before it can be catalogued or shipped. When it attains this state it becomes a piece of apparatus. Piece parts are constantly losing their identity, as they journey through a factory, by assembly into larger piece parts or "assemblies," these assemblies being swallowed up in larger assemblies, until the final assembly is made. Samples of telephone apparatus which pass through these stages are: switchboards, power boards, distributing frames, subscriber's set, desk stands, transmitters, receivers, etc. In the manufacture of these and additional forms of telephone apparatus, piece parts numbering into the millions are used.

Each piece part must pass through one or more operations before it is ready for an assembly and each assembly must, in its turn, be machined or otherwise treated until the apparatus stage is finally attained. The telephone apparatus shop of the Northern Electric Co. includes, therefore, completely equipped wood-working, iron-working and mechining departments in addition to those engaged on assembly work.

As it is impossible within the compass of an article to describe all of the manufacturing operations and assemblies incidental to the manufacture of telephone parts, a few outstanding ones of special interest will be dealt with.

Winding Induction Coils, Relays, Etc.

The manufacture of magnet wire has been described under the heading of conductors. This wire, after inspection, is transferred on wooden spools to the winding department, where—by means of small winding machines installed in front of work benches—it is wound in horizontal layers about solid or laminated cores, emerging finally in the form of induction, retardation, relay, receiver magnet or resistance coils, etc.

This operation is performed by girls seated at benches, as shown in Figure IX. While the transfer of the layers of wire, from the wooden spool to the coil, is accomplished by means of the winding machine, the wire is "cross-fed" or guided across the core by hand, and as it is extremely fine in gauge, great skill must be exercised so that convolutions will be regular and layers even. Girls employed on this work, as in the case of magnet wire insulators, develop a "touch" which tells them when all is not well. Under the latter circumstance, the winding machine is stopped and the uneven convolutions of wire unwound by hand, after which the winding operation is resumed. This "touch," which impresses the observer as a sort of sixth sense, is the result of years of practice, during which a degree of skill, bordering on intuition, has been gradually developed.

The Desk Stand and Subscriber's Set

The most widely known form of telephone equipment is probably the familiar "Desk Set," which, to the casual user, consists of a telephone receiver suspended from a hook; the latter projecting out from a vertical metal handle surmounted by an adjustable mouthpiece and supported by a conical metal base with a felt bottom. Equally obvious details are the two flexible cords, one of which passes from the top of the receiver down to a hole in the supporting base, the other passing from the base to a ringer box of polished cabinet wood fastened, usually, to the concealed surface of a desk.

If the subscriber is observant he will note that when he moves the receiver from its hook, the hook undergoes a slight change in position by springing upwards for a distance of about one-eighth of an inch. Nothing more in the external working of his telephone is apparent, and yet, in the space of a few seconds, if he is holding the receiver to his ear, the exchange operator's "number please," comes to him over the line. It is obvious to him that by some mysterious agency he has been connected with the switchboard, but there is nothing to suggest to him in what manner this has been accomplished. So he usually "lets it go at that."

Assembled into the upright handle, (which is a length of hollow brass tubing, with its outer surface either japanned or nickel-plated), is a terminal strip of galvanized steel, to which one end of each flexible cord is connected. Fastened to the side of this terminal strip, are three smaller nickel-silver strips,

FIG. 11—RECEPTION ROOM AT MAIN ENTRANCE TO THE GENERAL OFFICES.

FIG. 12—EMPLOYEES CAFETERIA DURING LUNCH HOUR.

insulated apart and having on their adjacent sides, platinum contact points. One of these strips is longer than the other two and is sprung against the inner or concealed part of the receiver hook. The weight of the receiver hanging on the hook is sufficient to hold this spring in such a manner that the contact points are kept apart. When this weight is removed, however, the points spring together, and a connection is established with the switchboard. That, in brief, is what happens every time the receiver is lifted from the hook.

Surmounting the handle, is the transmitter box containing the transmitter diaphragm—a thin disc of aluminum japanned on its outer side—and the carbon "button" assembly, which is connected with the terminal strip by means of a conductor running down through the interior of the handle. The carbon button and transmitter diaphragm are held in position by means of a galvanized iron bridge, which serves as a mounting for the transmitter assembly. The hard rubber mouthpiece with its perforated rubber back can be included as the final detail in this assembly.

The receiver assembly is simpler than that of the transmitter, and consists of a hollow rubber shell, into which is placed the receiver magnet. At one end of this magnet is the receiver diaphragm, protected by a hard rubber cap, while mounted at the opposite end is the concealed binding post, to which the flexible cord is fastened.

The ringer box or "subscriber's set" forms the last detail in this desk equipment. The ringer box is of polished cabinet wood, surmounted by two nickel-plated bells and contains an induction coil, a condenser and ringer coils.

The Multiple Switchboard

The largest, most imposing and most complicated piece of telephone apparatus is undoubtedly the multiple switchboard. Kempter B. Miller, in his "American Telephone Practice," refers to it as "That wonderful complex whole —the modern multiple switchboard," and when it is considered that any of the exchange operators can, without moving from her chair, connect up any calling subscriber who is connected to that exchange, some idea will be gained of the scope of a single section of one of these boards.

A multiple switchboard is built in sections, somewhat in the manner of a sectional bookcase. These sections are erected beside each other in the central office, expansion up to the limit of available floor space being thus provided for. The multiple characteristic is obtained by having all the subscriber's lines multiplied through all the sections, each operator being thus enabled to plug into the line of any subscriber.

The "Jacks" or switchboard terminals are mounted in strips, these held parallel in a hard rubber mounting by means of brass binders, known as "binding strips." Each exchange operator has on the vertical panels in front of her, horizontal rows of sockets belonging to three divisions of these jacks. The upper division comprises subscriber's multiple jacks, those in the middle division are trunk jacks connecting with other exchanges, while the lower division is devoted to subscriber's answering jacks. Figure VIII, showing a large multiple board in a central exchange, will make clear the jack arrangement, as well as the sectional construction of the board.

The manufacture of the component parts of a switchboard and also a part of its assembly is performed at the factory prior to shipment. Most of the assembly, however, is done at the exchange before erection, after which the connections with the underground cables are made through the main distributing frame.

Details in switchboard construction include the forged iron frame, screwed together in jointed sections—the keyboard with its horizontal row of assembled listening and ringing keys—the maze of rear connections and electrical apparatus including relays, induction coils, retardation coils, terminal strips and local switchboard wires; the assembled jack-strips and switchboard cable; the exterior wood work of polished cabinet wood; and the flexible cords with their plug terminals.

A necessary adjunct to the switchboard is the "Distributing Frame," which, as in the case of the switchboard frame, is fashioned from forged iron and assembled into standard sections. These sections are shipped to the various exchanges and are erected usually on a floor below the operating room. The distributing frame through the medium of "jumper" wires, serves to distribute the outside lines to their proper switchboard connections. The distributing frame wires may be cross-connected at will, this enabling a subscriber to change his residence in the same district and yet retain his original phone number.

Electroplating and Japanning

It is necessary that the outer surfaces of many telephone parts be protected against corrosion, and also that the appearance of certain parts be enhanced by a special finish. This is accomplished by nickel-plating, electro-galvanizing, or japanning the parts in question. If a nickel-plated surface is wanted, the piece parts are hung on brass racks; a row of these racks being then suspended into a plating tank containing a nickel salt solution. Opposite this row of racks are hung a row of pure nickel bars, which serve as anodes or positive poles, the racks of telephone parts providing cathodes or negative poles. Current supplied from a special generator causes the disassociation of the pure nickel anodes, the particles of which, carried through the solution by ionization, plate out at the cathodes, causing a deposition of nickel on the telephone parts. After an immersion of about forty minutes, the racks are removed from the plating baths, the plated parts then being detached from their hooks and transferred to a buffing department where they are polished on buffing wheels. Nickel-plated parts of desk sets, etc., are treated in this way.

Piece parts intended for service where protection from corrosion, rather than appearance, is desired, are electro-galvanized or zinc-plated. This is accomplished in the manner just described, excepting that the anodes are pure zinc bars, the electrolyte solution consists of a zinc salt, and the parts receive in this instance an immersion of twenty minutes.

The familiar black finish seen on the handle and base of the desk stand is obtained by spraying on a coating of japan with an atomizer. This coating is then baked to hardness in an oven.

FIG. 13—RED CROSS AND MEDICAL EXAMINATION

Figure X shows the Northern Electric electro-plating department. The tanks in the foreground, containing an acid solution, into which the various parts are dipped before immersion in the plating tanks; this dip serving to remove all foreign matter and provide a smooth plating surface. The operators are shown holding up the brass racks of attached telephone parts.

The General Manufacturing Organization

In the foregoing description, manufacturing operations have been dealt with from the standpoint of their actual performance in the factory. There are other phases of manufacture, however, which bear more indirectly, but with equal importance on the success of the final result. An adequate labor supply, for instance, must be secured, trained, maintained and compensated. Store rooms must be stocked with raw materials and supplies, and these in turn must be issued to the proper shop departments when needed. Each of the multitude of piece parts, which are passing constantly from operation to operation, must be at its proper place, at the proper time and in the proper way. The manufacturing cost of labor, raw material, machinery, tools and supplies must be carefully ascertained and kept, to serve as a barometric record on the economy of manufacture. A raw material, process and final inspection, including physical, chemical and electrical testing, must be conducted in order that a uniformly high standard of quality in the product shall be maintained. A power supply must be generated and distributed. Mechanical equipment must be kept in a state of repair and newer and better equipment must be designed and built, or purchased. Manufacturing methods must be subject to constant development and standardization. Time and motion studies, a necessary preliminary to the setting of piece work and bonus rates, must be conducted. Sanitary and attractive working conditions for factory and office employees, must be provided and maintained. To sum up the whole matter in a single word, all the stages and conditions in and surrounding manufacture must be planned and planned in advance. The operating branch, concerned with the actual performance of the manufacturing operations, is supplemented, therefore, by the following additional branches which attend to the more indirect details of manufacture:

(a) A production branch.
(b) A clerical branch.
(c) An inspection branch.
(d) A plant service and maintenance branch.
(e) A technical branch.
(f) An industrial relations branch.
(g) An installation branch.

These branches are subdivided into, and function through divisions and departments.

In order that the collective efforts of branches, divisions and departments shall attain their greatest impulse, an atmosphere of sympathetic and unselfish co-operation must circulate so thoroughly throughout, that no individual will escape its influence. The importance of this principle as a dominant characteristic in industry is being widely recognized to-day, and the sociological problems incidental to manufacture are receiving greater attention than ever. And they will receive even greater attention to-morrow. Walt Whitman's famous statement that, "Whoever walks a furlong without sympathy, walks to his own funeral dressed in his shroud," applies to life generally, and a great factory, with its assembled human medley, is just a manifestation of life.

Hexagon Making Scheme

By LEONARD SNARY

Thinking that you might be interested in the method which I used in drawing the hexagonal prism (as it appears to the eye), I will endeavor to explain the details, aided by an illustrative drawing This, so far as I know, is original.

After trying several different ways, I discovered the following, which serves the purpose.

Figure 1 is the mechanical drawing of the prism from which we make the "eye view drawing."

Construct a parallelogram E, G, F, H, using the face dimension of hexagon A B, which is 9/16 in., for the length E H. The altitude of the parallellogram may be any suitable dimension, but in this case is 5/16 in. The angle K L may also be any angle best fitted for the purpose, the one chosen here being 60 degrees. Find centre of the parallelogram by drawing lines from E to F and G to H. The distance between points C and D (Fig. 1) is 1 1/8 in. From the centre of parallelogram point o: 9/16 in. on each side horizontally. This gives points I and J, which are the same as points C and D, Fig. 1. Next joint points I, G, F, J, H, E, thus completing the top end of the prism, with the desired slope. To finish the drawing, carry down the necessary points to the desired depth, which is 1½ in., and the result will be a part top and a part side view of a hexagon prism.

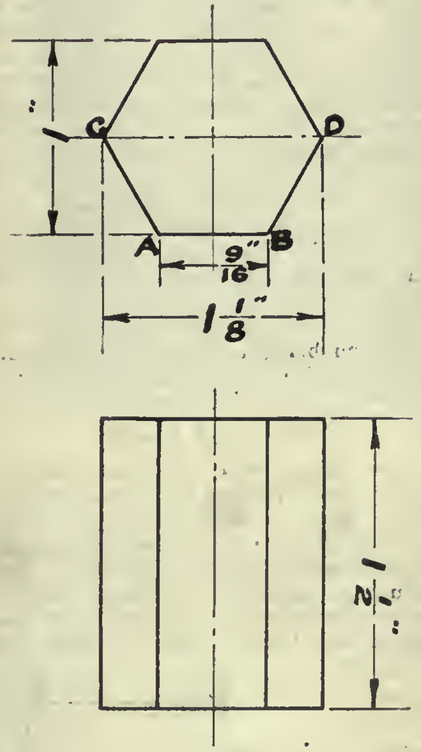


FIG. 1

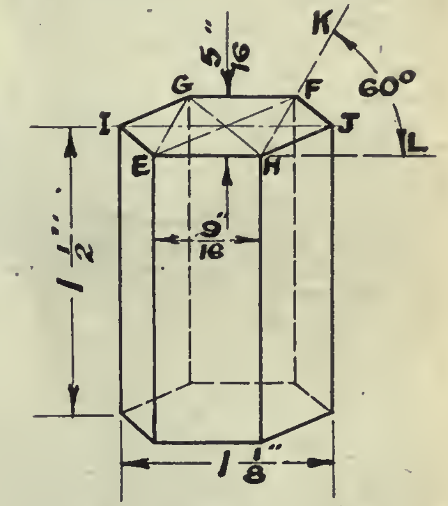


FIG. 2

Make haste slowly when opening an oxygen cylinder valve. There are two reasons why. In the first place, it is injurious to the high-pressure gauge to admit a pressure of 1,800 pounds into the Bourdon tube suddenly. The impact may burst the tube and ruin the gauge. In the second place the sudden compression of the air or gas in the regulator passage is accompanied by heat. The heat may be sufficient under certain conditions to destroy the regulator seat, thus letting the high-pressure oxygen into the diaphragm chamber and bursting the regulator.

A platinum substitute lately tested, according to the "Chemical Trades Journal," in Amsterdam, was an alloy of 89 per cent. of gold with 11 per cent. of platinum. This material, called "platino," withstood sulphuric, hydrochloric and nitric acids, and other reagents used in chemical work, and was unaffected by heating for half-an-hour in a smoky petroleum-gas flame. It proved equal or superior to platinum in ware for the chemist's laboratory, except for the large loss by corrosion when used in contact with a mixture of sulphuric and nitric acids.

Two French scientists have found that X-ray screens made of a compound of tungsten and cadmium give better results than platinum ones at far less cost.

The Booth Rotating Brass Furnace

A Type of Electric Brass Furnace in Which the Shell is Rotated. This Results in Less Zinc Loss Through Vaporization and a Longer Furnace Life.

By Carl H. Booth
Pres. Booth Hall Co., Chicago

FIG. 1—ORIGINAL ROTATING FURNACE.

ABOUT five years ago we were associated in the design of several electric furnaces for the production of special chemical compounds. These furnaces were cylindrical in shape and arranged to rotate about a central axis through which the electrodes projected. At the time it was suggested that this type of furnace could be adapted to the melting of non-ferrous metals, but there was no opportunity to carry on such work. An illustration of one of these furnaces is shown in Figure 1.

In these earlier furnaces a door was provided in the cylindrical surface of the shell and lining, for charging and pouring, but we experienced considerable difficulty in maintaining the lining around this combination spout and door. Further, in pouring the furnace it was troublesome and inconvenient to be obliged to place the ladle between the supports beneath the furnace. Consequently, in designing the present Booth Furnace, these difficulties have been overcome by placing the door in one end of the furnace, as shown in Figures 2, 3 and 4, and having a tapping hole in the other end, as shown in Figures 2 and 3. In this way the cylindrical surface of the lining and shell is unbroken by any opening. This permits the continuous rotation of the furnace, and consequently the absorption of heat by the charge from all parts of the lining, which means no local overheating and uniform wear.

Capacities

As a general rule, the quantity of non-ferrous metal melted at one time, or at one heat, is less than the quantities involved in the melting of steel and iron, and, therefore, smaller sizes of furnaces are desirable.

To meet the requirements of the small foundry, as well as the large foundry, and the smelters and refiners, Booth Furnaces are built in the following sizes:

Rater Holding Capacity	Maximum Holding Capacity
250 lbs.	350 lbs.
500 "	750 "
1,000 "	1,500 "
2,000 "	2,500 "
3,000 "	4,000 "

There are many small plants where heats of 50 to 350 lbs. are required, and the smallest size furnace shown above answers the purpose with great economy, whereas larger furnaces to operate efficiently must produce more metal than is needed. Further, there is also a great disadvantage in trying to pour a ton of brass into small castings and keep the metal hot. We know of a large company having a one-ton electric furnace where it is taking them 50 minutes to pour a heat into castings, and they are finding great difficulty in doing so. Further, the great variety of mixtures made by many small foundries requires a small, efficient unit, from which "short" heats can be taken, producing great flexibility of operation. On the other hand, smelters and refiners frequently require furnaces of relatively large holding capacity, which will turn out a considerable amount of metal per day.

Any one of the above furnaces will melt and bring to pouring temperature a charge of its rated holding capacity in an hour's time, when the furnace is hot.

Mechanical Details

The illustrations and drawings give a very good idea of the general design of the Booth Electric Furnace.

Figure 2 is a cross-section or diagram, illustrating clearly the principle of construction. As will be noted the furnace rotates on rollers, and is carried by two cylindrical tracks. The rollers are driven at the proper speed by a motor, so as to rotate the shell at a speed of two revolutions per minute. No gearing is required encircling the furnace. The current is carried to the electrodes by means of short pieces of flexible cable, which connect to the above-mentioned track, and the current is supplied to the track by means of shoes which press against them and form a sliding contact. The electrodes are regulated by means of screws shown, and on small furnaces are entirely hand-operated, but on the larger furnaces automatic electrode control is used, thus doing away with the necessity of close watching on the part of the operator.

In the small furnaces, the door is in one end only, but in the larger furnaces both ends are provided with a door.

Figure 3 is a photograph of a rear view of a 250-lb. Booth Electric Brass Furnace, in the foundry of Leitelt Brothers, Chicago. This shows the charging door open ready for charging. The latch which holds the door shut when the furnace is charged will be noted and also the electrode projecting through the door. A door of similar type with electrode projecting through it has been in use for a considerable period in the construction of the Booth-Hall steel melting furnace, built by our company. The contact shoes are shown in this view pressing against the track.

Figure 4 shows the same end of the furnace after it is charged and the furnace is ready to run. The flexible cables from the track to the electrode holder are shown, as are also the water-cooling connections for cooling the electrodes. It is not necessary to open the door until after the heat is poured. The door is then opened for charging.

Figure 5 shows a front view of the 250-lb. Booth Electric Brass Furnace, and illustrates well the cylindrical drum type shell and the track driven by the rollers. This also shows the bronze

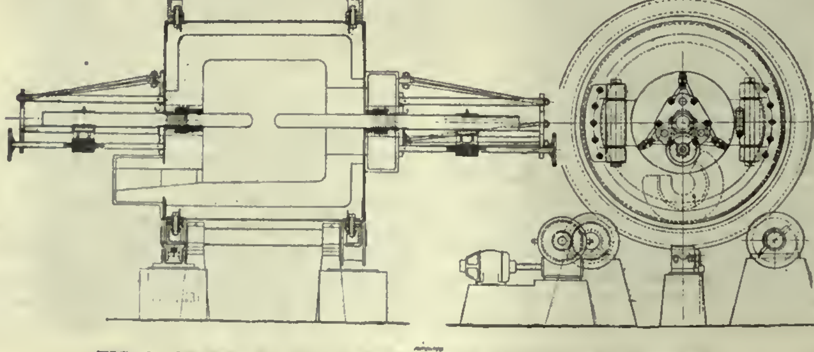


FIG. 2—CROSS SECTION AND END ELEVATION OF FURNACE.

shoes which carry the current to the track and the flexible cable connected with the electrode holder and the water connections. The pouring tap is shown directly beneath the electrode holder frame.

Figure 6 shows a side view of the furnace. The cable supplying the power to the furnace is shown on both sides, coming from conduits in the floor to the bronze shoes. These are the only connections necessary to carry the electricity to and from the furnace. The contractors are shown on the switchboard, together with push-button control for starting and stopping the furnace.

In pouring the ease with which the men handle the ladle up to the furnace, and the operator controls the furnace at the switchboard by means of push-button control, add greatly to economy in operation and to the comfort of the crew.

Lining

Probably the most important of all factors in reliable and efficient furnace operation is the lining. Especially is this true with the melting of non-ferrous metals, where a lining with many joints will have a decided tendency to absorb metal. In order to overcome this difficulty the lining provided with the Booth Furnace is made with as few joints as possible.

In lining the furnace the electrode supporting mechanism at either end of the shell is removed by simply unbolting same from the end plates. These are made as a unit and in taking them off they do not get out of adjustment or out of line, and therefore do not require any adjusting when put back in place. The shell is then lifted off the rollers by suitable hoist or crane, just as if it were a barrel and is turned on end so that the end plate of the furnace shown in Figure 3 can be unbolted and removed from the shell.

Figure 3 shows to some extent how this lining is made. The door is made of one solid piece of brick with a hole in the centre through which the electrode projects. The cylindrical part of the furnace is made of two cylindrical tiles, which fit together with a tongue and groove joint in the centre, this joint being filled with heat-resisting cement. The ends of the furnace are each lined up with four special bricks, joined together with cement and cemented to the tile. In this way we really have a large crucible electrically heated, but with walls of considerable thickness, and a minimum number of joints. Further, this lining does not require a brick mason to instal it, but can be put in with common labor. This special brick lining is backed up with a layer of heat-insulating material, so that when the furnace is at working temperature, the temperature on the outside of the shell is so that the hand can be placed upon it. Compare this with the large amount of heat in the neighborhood of a crucible or other fuel fired furnace, and it will show you how much easier it is to get men to work around a furnace of this character.

The time required for relining this furnace is 8 to 12 hours.

Charging

In starting the furnace the tap hole is plugged with moulding sand, the charge placed in the furnace, the door closed and the power thrown on. The electrodes are then brought together by means of the moving mechanism shown in the photograph and the amount of current flowing regulated by moving the electrodes closer together or further apart, as indicated by the meter on the switchboard.

Methods

If turnings, floor sweepings or grindings are used the rotation of the furnace is started at once and continues until the metal is ready to pour. We have never broken an electrode in operating in this manner. If ingots or heavy scrap is used, the furnace remains stationary until the ingot is partly melted, and then rotation is started and continued until the metal is ready to pour. We have experienced no difficulty in regard to breaking electrodes when this method is followed.

As the furnace is sealed up quite tightly from the time the power is on until ready to pour, we have obtained very good results as to metal temperature by keeping the power practically constant for a definite length of time. After the operator has poured a few heats, it is possible for him to determine the right temperature practically every time without opening the door and inspecting the metal in the furnace.

Pouring

In pouring the furnace, the pipe stands which carry the water connection simply lift out of the way without it being necessary to unbolt anything, and the men can go right up to the furnace with the ladle.

When the furnace is ready to tap the operator stops the rotation until the tap hole is above the level of the holder, and thus above the surface of the metal. The tap hole is then opened by means of a sharp-pointed steel rod. As the tap hole is simply plugged with moulding sand there is no sledging or pounding required, as we have found it can be very readily picked out if a small pointed rod is used. We have never had any trouble with the tap hole. After the tap hole is opened, the furnace is rotated down until the opening is below the surface of the metal, and the metal poured out into the ladle as illustrated. If it is desired to only remove a portion of the metal, the furnace is again rotated back and the tap hole brought above the level of the metal in the furnace.

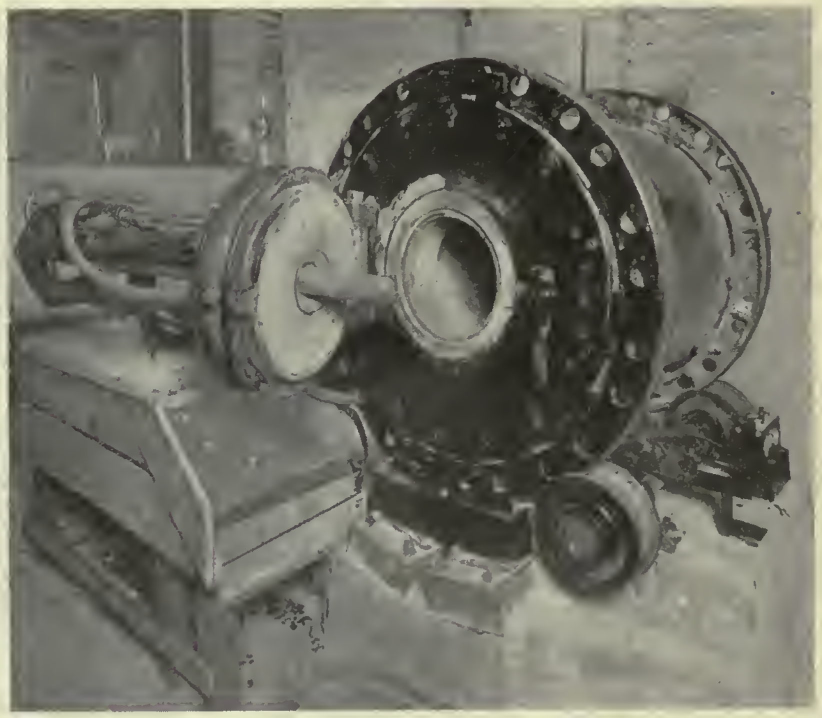


FIG. 3—SHOWING METHOD OF CHARGING FURNACE.

On account of the fact that there are no swinging cables connected with the electrode holders, it has been suggested that the furnace itself could be picked up from its rollers by means of a crane and the metal poured into ingots or castings. We have not attempted to do this as yet, but it seems to be entirely feasible.

Operating Records

With the small furnace which is in the plant of the Leitelt Bros., Chicago, we have poured about 130 heats, using a great variety of mixtures and pouring a considerable number of different grades of metal. We have used:

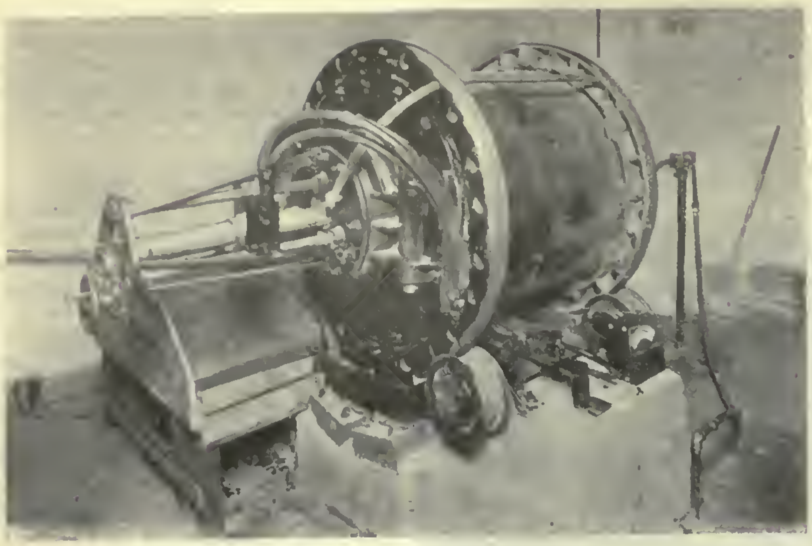


FIG. 4—ARRANGEMENT OF ELECTRODE GEAR.

Yellow brass turnings and borings; concentrates from floor sweepings; grindings; foundry scrap; copper wire; sheet copper; red brass ingots; yellow brass ingots; copper ingots; pig tin; lead pipe; pig zinc; German silver.

So that the furnace has been thoroughly tested on many classes of material.

Power Consumption and Shrinkage

In melting down turnings, borings and grindings with a hot furnace, 30 to 40 minutes is required per charge. With the small furnace shown a power consumption as low as 240 kw. h. per ton has ben obtained. The average would be between that and 300 kw. h. per ton.

With yellow brass turnings and borings which are fairly clean, but on which no attempt has been made to remove any contaminating material, heats have been run with a total shrink of 1½ per cent. These borings, when charged, were in the same condition as received from the seller. Of course the percentage of shrink will depend on the amount of oil, dirt, iron and other extraneous material present, but the actual metal loss has proven to be very low. Due to the active mixing action of the rotation, the heat is applied to the turnings and borings in such a uniform manner that there is no local overheating, and a quick melt with low metal loss is obtained.

In melting concentrates from floor sweepings, which contain a considerable amount of dirt and moisture, and which when melted in crucibles showed a shrinkage of 30 to 40 per cent., the Booth Electric Furnace over quite a number of heats averaged 17½ per cent. shrinkage.

In melting ingots and heavier brass scrap, a heat will average from 30 minutes to an hour in length of time, depending upon the kind of metal poured and the size of the charges. A 300-lb. charge of copper ingots requires about an hour to melt and pour, while a 300-lb. charge of yellow brass about 40 minutes. The shrinkage with yellow brass ingots averages about 1 per cent. and on red brass and high copper bronze under 1 per cent. With the furnace hot the power consumption will run from 250 to 350 kw. h. per ton.

One heat was made with a charge running about 50 per cent. zinc and 40 per cent. copper, totalling 250 lbs. 249 lbs. of metal were poured and the power consumption was 240 kw. h. per ton. This was in the latter part of the day when the furnace was hot, and the metal charged was all clean metal. The ladle was weighed as it was brought to the furnace, and then weighed after the metal had been poured into the ladle. Great care was taken on the part of the operators not to overheat the metal, and this is simply an indication of what results are accomplished where sufficient attention is given to melting. The heat following was a charge of 225 lbs. of red brass ingots, from which 224½ lbs. of metal was poured.

It is particularly difficult to keep account of the metallic shrinkage in a small furnace of 250 lbs. holding capacity, and consequently great care has been exercised. Arrangements were therefore made for a scale near the furnace, upon which the heated ladle was weighed when brought to the furnace and again weighed when filled with metal. Any drippings from the furnace were carefully collected and weighed and any slag coming out with the metal was skimmed from the pot before weighing, as even a small amount of one pound would mean almost onehelf of one per cent. shrink. With a larger furnace, it would be much easier to make shrinkage tests without danger of as large a proportionate loss as with the smaller furnace. In other words, if one pound of metal poured did escape being weighed, it would not represent as much shrinkage as in the case of a small furnace.

Lining Wear

To date about 130 heats have been run and the lining on the furnace illustrated shows no perceptible wear. The lining is sintered upon its surface and appears to be in as good condition as when originally installed. This is the first lining installed in the furnace. The material of which the lining is made is such that it does not shrink, spall or crack, although the furnace is run on an average of 8 hours per day. Based on a great many years' actual experience in the operation of electric furnaces of many types, our engineers feel confident that linings of this type will last from 600 to 1,000 heats, and possibly longer, with proper care on the part of the operator.

Another important characteristic of this method of lining is due to the fact that there are practically no joints, which serves to keep the lining clean and prevents any considerable amount of slag or metal sticking to it.

Electrode Consumption

With furnaces of this type the graphite electrode is to be preferred, due to its greater conductivity, which permits the use of the smallest size of electrode practical for the current to be carried. On this furnace electrodes of 2½ inches diameter are used, machined and equipped with what is known as nipple joint. These are 30 inches in length. The electrodes enter the furnace through graphite sleeves. This opening is also protected by a water-cooling copper casting

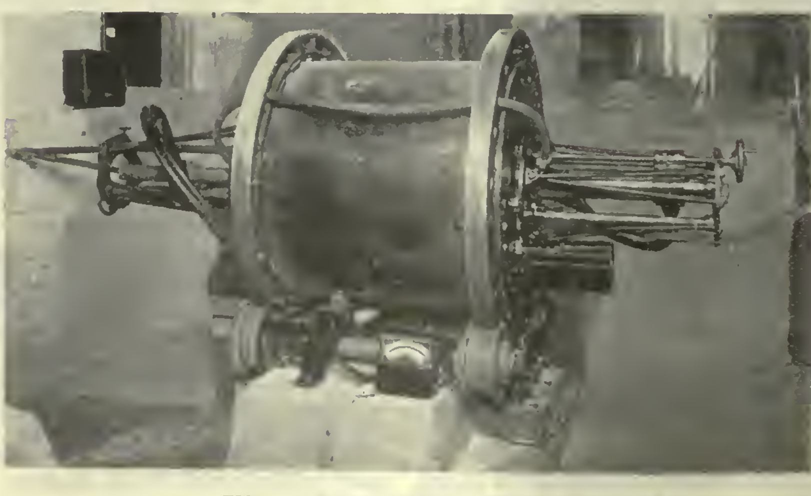


FIG. 5—GENERAL SIDE VIEW OF FURNACE.

which serves to protect the electrodes from burning at this point.

Even with the small 250-lb. furnace shown, the electrode consumption is low. If the furnace is kept in operation fairly continuously during an 8-hour day, the consumption will average about 3 lbs. per ton.

The electrode supporting mechanism has been so designed that it not only permits of adjustment in case electrodes are slightly out of line, but at the same time serves to protect the electrodes from breakage, due to the accidental falling of bars or other material against the end of the furnace.

Power Factor

A great deal of difference of opinion still exists among operating engineers as to the proper power factor best to be used in connection with electric furnace loads. With small furnaces of the type just described, our judgment is that as low a power factor should be adopted as can safely be permitted with the conditions met with at the point of installation. This can be varied to suit different conditions by modifications in the design of the equipment. If a power factor as low as 70 per cent. is permitted, the result will be that the furnace operator need not stay at the electrode hand wheel control to any great extent, but may be employed in getting his charge ready for the next heat, making suitable records and other miscellaneous duties. If, however, a higher power factor is required, the furnace can be readily operated, but will require more attention on the part of the operator unless automatic electrode regulators are provided.

It is our judgment that in case of installation of a battery of small furnaces, providing a sufficient advantage in power rate could be obtained by obtaining a higher power factor than 70 per cent., it would be best to instal automatic electrode regulators. There would also be compensation in reduced labor cost due to the fact that one man could take care of a large number of furnaces under such conditions.

Labor

On small furnaces of the size described, one furnace operator can conveniently handle three furnaces without the use of automatic electrode control. This would of course not include the miscellaneous labor for charging and making up the heats, but one extra man could easily take care of this.

With the 250-lb. furnace described by this paper, we can easily charge, melt and pour a ton of metal in 7½ to 8 hours. This same rate of speed is maintained for all sizes of Booth Electric Brass Furnaces. With the larger sizes, it will of course take a little longer time to charge and pour, but proper mechanical means can be provided for charging so as to reduce the time to a minimum. If the furnace is used entirely for melting turnings and borings and other small scrap the daily output will be slightly increased.

Advantages

1. In designing the Booth Electric Rotating Brass Furnace it has been the aim of the designers to produce a furnace which was efficient enough so that it could be built in small sizes suitable for adaption by the small brass foundry; at the same time such a furnace must be strong and rugged in construction, have few parts and be simple electrically, not requiring the supervision of an electrical engineer or other expert.

2. At the same time furnaces of this type can be built in large sizes and offer as many advantages to those plants requiring a large tonnage of brass, as is true with a small foundry.

3. The charging door of the furnace is located at the opposite point from the tapping. If a battery of furnaces is installed in a plant, it is a great deal more convenient, and economical both in the labor cost and in the handling of materials to have the charging operations carried on at one end of the furnace, entirely separate from the tapping and pouring. This also saves in floor space as the furnaces can be located very close together under such an arrangement.

FIG. 6—SHOWING SWITCHBOARD AND MOTOR FOR ROTATING.

4. In pouring the furnace the tap hole is opened without coming in contact with the metal, and as the furnace is rotated by the motor the metal pours out and can either be collected in ladles or could be poured directly into moulds or ingots brought up to the furnace by approved mechanical means. It is also entirely practicable to pick the furnace up off its rollers and carry it by means of suitable electric travelling crane over to the moulds and pour directly into the moulds. This method would be especially well adapted for pouring ingot moulds or the casting of slabs. After the furnace was poured it would then be returned and set on the rollers, charged and started in operation. Since there are no cables to be disconnected or other electrical connections made, this can be readily done.

5. The absence of overhanging cables and the simplicity of the electrical connections is one of the great advantages of the Booth Electric Furnace. This is readily apparent and is referred to again simply for emphasis.

6. Where a large number of Booth Furnaces are installed in one plant, we recommend the purchase of an extra furnace shell, which could be kept lined up ready for service. This will be particularly valuable in the case of plant operating on 24-hour basis, as it would save time in shut-downs. The method proposed would be: as soon as the lining of one of the furnaces in use was worn out, the furnace needing a new lining would be lifted off its rollers and the spare furnace set in place, immediately charged and started up without losing more than half an hour's time altogether. The furnace shell which was removed could then be allowed to cool down and new lining placed in it ready for further use.

7. The important reason why electric furnaces are being adopted by plants melting brass is because of the large saving made in metallic shrinkage. The construction of Booth Electric Furnace is especially noteworthy in this respect, and all advantages due to the movement of the metal are secured by the rotation of the furnace.

8. Where mixtures are used which might result in the formation of much gas pressure in the furnace, the charging door or doors need not be luted up so as to permit of the escape of the gas pressure without blowing out the end of the furnace, as we understand has been the case in a number of instances where sufficient openings have not been allowed. This can also be accomplished in a very simple manner by leaving the tap hole open for a short time in case it is desired to burn off the oil and dirt prior to the melting of the charge. In other words, with a charge of turnings and boring which are dirty and oily, the furnace can be left in a stationary position with the tap hole open. The furnace being turned around on its rollers so that the tap is located at the top position instead of at the bottom, which would be the position in pouring. This open tap permits the burning oil and fumes to escape. As soon as the operator notes that metallic vapors are coming off, the tap can be plugged up with moulding sand and the rotation of the furnace started.

9. The complete rotation of the Booth Electric Furnace results in more even wear of the lining, a greater absorption of heat by the metal from the same, which naturally results in an improved power consumption. These factors help

Continued on page 171

Canadian Machinery Drafting Course—Part XI

Continued From January 15th Issue. We Caution Students Against Some Common Pitfalls, Pointing These Out on the Plate. The Building Up of This Vise Should be Watched With Interest

By J. H. MOORE, Associate Editor Canadian Machinery

WE left off at the term, finish all over in the last section, so now let us go on to the subject of proper dimensioning. To say what plan to follow out is difficult, for every drawing office follows out the instructions of its chief, but for the purpose of this course we will decide to keep everything in inches. A practice often adopted is to call anything over 24 inches by the term, feet and inches, but as stated before we shall stick to the term inches only.

When micrometer or gauge measurements are required, all dimensions should be given to at least three decimal places. In some cases, closer dimensions would be essential, but for the average case three will be found to be sufficient, as that allows the working to one thousandth of an inch. Be careful where you place your decimal point.

For example, take 6·346. This method of placing the point near the top is not good practice. It should be written thus, 6.346. Note that the point is directly at the bottom and not near the top. In a case where the dimension is less than one inch, a zero should always be placed ahead of the decimal point. This avoids all confusion and makes for safety. We will suppose the dimension to be .346 in. We will further suppose that in tracing this point was rather weakly inked in, and did not show in the blue print. To further complicate matters, a speck of dirt got in between the 3 and the 4, with the result that the dimension showed up as 3.46. This may sound like a fairy tale, but the writer has found this condition to happen at the most unexpected time. Had the dimension read 0.346 it would have made things much easier. True, one might say—well, why not take it for .0346, still the possibility in such a case for error is not so great. When possible, all dimensions should be given so as to read from the bottom right side of the drawing.

Start dimensions from a finished surface or a predetermined centre line wherever possible.

Last but not least, watch your arrowheads and dimension lines. Never make dimension lines as heavy as the others, and be sure to carry them out to the proper point. Never let an arrowhead stop before it touches its dimension line, nor never let an arrowhead go over the line. Above all, make sure you put them in. This may sound like useless preaching, but it is an easy job to miss out arrowheads and dimension lines, easier in fact than one would imagine.

On plate No. 11 which we reproduce in this section, we have purposely made mistakes in order to point out the common pitfalls encountered by the tyro. We do this in order that he will not do likewise, but avoid them by having them pointed out so plainly.

We announced in section 10 of the course that we had secured various portions of a well-known miller for use, and readers can, no doubt, appreciate the value of such practical plates to work from.

It is not often that in a course of this nature actual design is allowed to be shown, but time goes on, and as this course advances readers will see how valuable the saving of each issue will be to them.

To commence with, we have taken the type of milling vise illustrated at Fig. 1. To those engaged in the machine shop industry, its appearance will be familiar, but to others not so engaged a careful study will be worth while.

In this plate we will consider the small details, the next the base, in the next the swivel base, and in the final plate, the assembling of all the parts. For this reason we would advise students to carefully follow out all instructions. First, we must change the dimensions of our plate on this occasion. Make it 16 in. x 16 in. to border lines, and leave ½ in. space all around. This leaves the paper actually 17 in. x 17 in.

Starting at Fig. 1, we notice the jaw of the vise. This piece should be easy for the student to lay out, so no comment or help is offered in this regard. We will, however, call attention to four points in connection with the drawing. Note the C's'k to illustrate countersink. Some offices practise this abbrevation, but personally, we believe it to be too short. Attention is called to the fact that only one arrow head and line reaches this notation, while it would be good policy to place another line leading to the other hole.

Next, three views are shown where two is all that is necessary to fully illustrate the nature of the piece shown on the end view (providing this view had been necessary), there is dotted outline of countersink screw hole. This is still another omission. Students will notice the f.a.o. sign. This is a very brief method of stating finish all over. Lastly, look at the underline which reads jaw wanted steel. This is poor policy to merely state steel. There are numerous grades of steel ranging from ordinary carbon steel to the high speed variety. Always state, if possible, the grade of steel desired.

Let us go on to Fig 2. Again we give the reader no help in the layout of this part, it being so simple. Note the only two views are shown, this being sufficient. On one of the holes in the plan view we have marked 17/32 in. but left out an arrowhead. On the other hole we have omitted the dimension entirely. While a workman would take it for granted that both holes were of similar size, still this is not good policy. A better plan would be to make a notation, as shown at Fig. 1 between the two holes and run lines and arrowheads to each hole. On view No. 2 is also illustrated a better method of showing the term finish all over.

In the layout of piece No. 3, it is good policy in a view of this nature to draw your centre line first. Students will note the convenient system of showing a square thread. While this method is not absolutely correct it is permissible, and is used in a great number of drawing offices. Its chief advantage is speed, with ease of understanding what is wanted.

In stating the number of threads per inch, we have omitted to mention square thread. Be very careful on this point, for there are so many various standards of threads, the U. S. system, the V system, and so on.

Next, the dimension of the diameter of the thread is left off. While, no doubt, one could look at another portion of the view and see the 3/4 in. dimen-

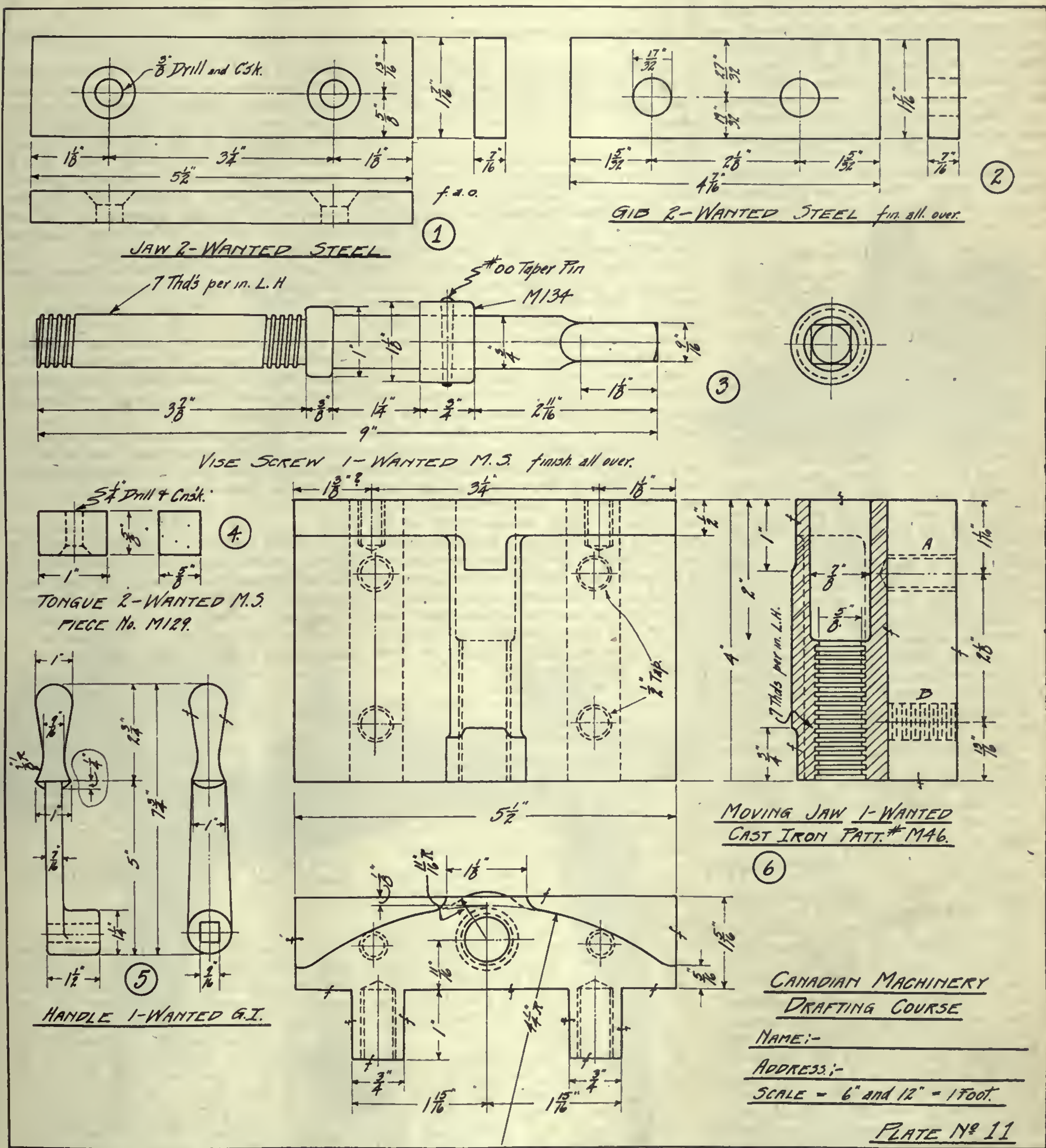
FIG. 1—SHOWING THE VISE, WITH AND WITHOUT THE SWIVEL BASE.

sion, still it is a risky proposition to take it for granted that this dimension is what it was intended. To those reading drawings, we can only say, never take anything for granted—find out to be sure. Better be sure than sorry.

Let us now refer to the note calling for a No. 00 taper pin. In some cases, this note would be considered O.K. by firms who believe in leaving the question of length to the machinist, but in the majority of cases not only is the size of the pin given, but also the length. The latter policy is much the best, for it leaves nothing to be conjectured about, but issues definite instructions. For example in the case illustrated the note should have read No. 00 taper pin 1¼ in. long.

Another point to be watched is the method we have employed in dimensioning the square end portion of this screw. We have carelessly marked 9/16 in. leaving it to the common sense of the machinist to see from the end view that the piece is square. Suppose there was no end view shown, what guarantee would he have that it was not 9/16 in. diameter, or even 9/16 x 3/4 in.? To overcome this danger, we can adopt two styles of dimensioning. First, we could write 9/16 in. sq. where we already have the 9/16 in. dimension, or better still, we should place the dimension lines on the end view and mark plainly 9/16 in. sq.

The last point on this piece No. 3 is our marking in full, the fact that the piece is finished all over. Thus we have



A CAREFUL STUDY OF THE PLATE IS ABSOLUTELY ESSENTIAL. WE HAVE PURPOSELY MADE SEVERAL ERRORS, WHICH MUST BE CORRECTED ON THE FINISHED DRAWING. ABOVE ALL SEND US IN YOUR WORK.

shown three styles f.a.o.—fin. all over—and finish all over. Either one is permissible, and it depends on what office you are employed in, what system is adopted. To those working on the bench and machine we can only add, watch these little details, if for nothing else than for curiosity's sake.

At Piece No. 4, the first point we wish to call attention to is the snaky line leading to the note ¼ in. drill and cnsk. This style of wavy line is used by quite a number of offices in place of the straight line, such as the one on Fig. 3, leading to the 7-ths. per in. L. H. Note it is merely a matter of taste which is used, some claiming that the straight style of line leads your eye quicker to the dimension, while others claim that the wavy line attracts your attention more than the straight line. We show both types merely for illustration purposes. Note also on this view that we have marked under the title the words Piece No. M129. This system of keeping track of the details by piece numbers is worth while explaining.

The Method Involved

Supposing a machine was being built consisting of some 400 to 500 parts. To keep track of these parts without some system of numbering would be almost impossible, and result in needless waste of time, so the following plan is carried out. Some letter is taken to represent the machine. In our case M is used to represent the word miller. As a rule the numbers start at the castings, and are numbered up all through the castings first, then the steel pieces, etc., etc.

In other cases, some firms start at the base of a machine, and number consecutively all the pieces as they come up from the floor as we might say. The method adopted depends on the drawing office, but it is the fundamental principle that really counts. Keep track of the pieces, with some symbol and number, thereby eliminating waste of time and needless confusion. Students will note that we have left off the notation fin. all over on view No. 4. This is done in some cases where the draftsman figures to himself that anybody would know that the piece should be finished all over, BUT—and it's a large one, the draftsman has no business to imagine that anyone should know what his intentions are.

Fig. 5 illustrates the handle for the vise, and its only finished portion is at the handle grip. This is represented by the small f's shown. A very simple detail, and yet one not receiving the attention it deserves, is the one showing ¼ in., and which we have surrounded with a rough circle form, in order to call attention to it. Note that we have not the space to place our dimension between the arrow lines, so we carry the dimension out to one side, but also carry out a dimension line, or shall we call it a dimension attention line, to the ¼ in. This is always good practice. In any case where a dimension is placed outside of the regular lines, lead a dimension attention line to it. While this may not appear such an important point in a simple drawing such as shown, it is a very vital detail when used on an intricate drawing of any nature. By the adoption of this system, confusion is avoided.

We also made an error on piece No. 5, by merely stating 9/16 in. at the square hole through the handle. Does this mean you have to machine a 9/16 in. square hole from the solid? We hear the machinist say, "We hope not," and this remark is certainly called for. The dimension should be marked 9/16 in. core, in order that the patternmaker can make arrangements to place core prints on the pattern, ensuring the hole being cored in the casting.

We next come to Piece No. 6. First, we would call attention to the plan view. Note that in the representation of the tapped hole of square threads we show only a double line. This is permissible in some cases, especially where we have a section such as shown in the side view, which illustrates clearly the nature of the thread. Again we have left off the fact that square threads are wanted. We do this simply to illustrate how easy it is to forget the little term, square. Referring to the sectional view, we call attention to the fact that arrows have been left off, and dimension lines not completed in order to warn students of their danger. We leave them to pick these points out for themselves.

In representing ordinary tapped holes two methods are often adopted. Each of these methods is shown in the sectional view. First, the plain double line system is often adopted, as shown at A on the view, and second, the better method as illustrated at B is used. While the latter takes a little longer, it is plainer and gives at a glance the information.

The front view of this piece has a very good illustration of what we meant by a dimension attention line. Note the dimension 11/16 in. radius. Here we have a case where, to place the dimension inside the dimension line would make it crowded, but by leading a line out as shown, it gives the dimension prominence, and yet is not hard to discover where it belongs to.

In concluding this portion of the course, we wish to give students a little advice. Do not merely copy plate No. 11. Study it. Figure why each piece is made the way it is. Study your projection. Watch all dimensions, and above all do not make the same mistakes on your plate that we have on ours. We have done so purposely to point out the common pitfalls, and thus keep others out of them. Ink in your work with care, and if you care to do so use tracing cloth. We do not make this a necessary stipulation, simply because we may have some students who do not care to go to the expense of having cloth. If you so desire, send work in on the regular drawing paper.

Lately, some of our students are adopting the easy (?) method of WRITING in their name and address on the title.

Such a practice should be avoided. Lettering practice is what the title is there for, so print in every item, do not write a word of it. Please watch this point in future.

Next plate, we will go further into the details of this vise. Send your work in promptly, and let us know how the course is interesting you.

Cut out and send with drawing

Name ....
Address ....
Position ....
Firm's name..

German silver is manufactured in three general ways. It is composed of nickel, copper and zinc in varying proportions. The German method of manufacture is to melt all the copper to be used in the mixture, and two-thirds of the nickel and zinc, in a graphite crucible and then add the rest of the nickel and zinc. In the English method, the copper, nickel and zinc are melted all at one time, then more copper and zinc are added. Should the metal appear porous, a fire-clay pipe containing pitch is pushed into the metal mixture to deoxidize it. There are several American methods. According to "Indian Engineering," one is to melt a copper-nickel alloy and then gradually add the preheated zinc. In another method monel metal is used as a base.

The feasibility of using waste hemlock bark from paper-mill operations for tanning purposes has been demonstrated in recent tests made by the Forest Products Laboratory of Madison, Wis. It is asserted that the product is satisfactory to the tanner and can be prepared at a cost that will allow it to compete with leaf bark. The use of paper mill bark for tanning would mean a source of income for paper mills from a material which is now considered of little value, if any.

DEVELOPMENTS IN SHOP EQUIPMENT

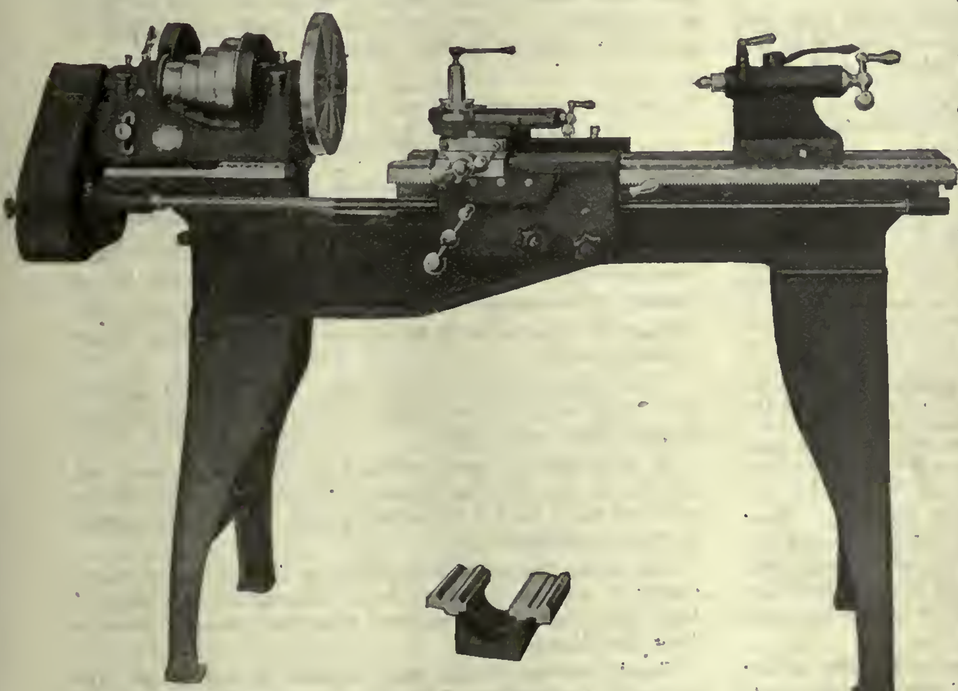
STAR GAP LATHES

The Seneca Falls Manufacturing Company, Inc., Seneca Falls, N. Y., have just brought out two sizes of Gap Lathes 11 in. x 18 in. swing and 13 in. x 21 in. swing. In designing the "Star" Gap Lathes, the extra capacity feature of the "Gap" has been added to the quality, convenience and efficiency of the well-known "Star" Screw Cutting Lathes.

The bed is of the box section type, thoroughly braced by cross webs and made very heavy through the Gap section to insure usual "Star" Lathe accuracy. A bridge piece is furnished to close up the Gap when the extra swing of the Gap is not needed. Beds are made 5, 6, 7, 8, 10 ft. long.

The carriage has the cross slide placed at left hand for convenience. The cross feed screw is supplied with micrometer collar graduated in thousandths of an inch. The apron has safety device, so that longitudinal feed and split nut cannot be engaged at the same time. Has extremely wide range for screw cutting all standard threads from 3 to 72, including 11½ and 27 pipe threads. Can be equipped with transposing gears or metric pitch lead screw for cutting metric threads.

An unusually large line of attachments, including raising block, quick change gears, taper attachment, motor drive, draw-in chuck, milling and gear cutting attachment, turrets, relieving attachment, etc., may be used on the "Star" Gap Lathes.



A GENERAL VIEW OF THE LATHE. NOTE GAP PORTION UNDERNEATH THE BED.

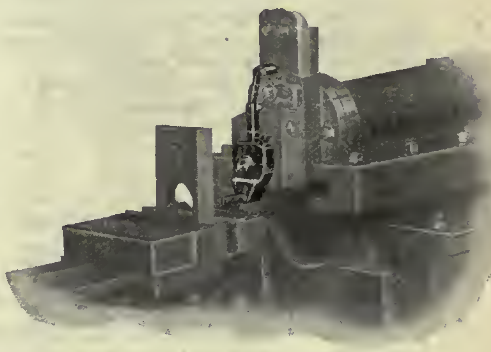
NEW SAW TABLE

Woodworking plants of all kinds will be interested in a description of a new saw table produced by the D. MacKenzie Machinery Co., Guelph, Ont. The table will take the same work as one of larger dimensions, although it is only 23½ in. by 30 in., the distance from saw to ripping fence is 12 in. by 13 in., and the floor space 3 ft. by 3 ft. 6 in. The machine is adapted to electric or gasoline drive, and each is furnished with belt, ripping fence, two mitre fences and 9-inch saw. It is a useful machine not only for furniture, piano and sash and door factories, lithographers, contractors, pattern shop, etc., but is also designed to meet the requirements of technical and manual training schools. The saw table will prove an important addition to the McKenzie line of power hack saws, sensitive bench drills, shapers, and 14 in. by 6 ft. and 8 ft. engine lathes.

BRUNO SLOTTING ATTACHMENT

The H. H. Moore Co., Rochester, New York, have placed on the market what is known as their Bruno Slotting Attachment.

This attachment, or cutting tool holder, can be used on shaper or planer, and makes internal shaping of any description, such as dies, jigs, gauges, keyways, possible.



VIEW SHOWING FIXTURE AT WORK.

The attachment is simple in construction, made of high-grade steel, heat treated, hardened, and fully guaranteed. It is applied to the shaper as quickly as you can change a tool in a tool post, which makes it practical and efficient.

You will note that the tool is bolted to the Clapper in place of the tool post, allowing the use of very short, stiff cutting tools, as no projecting tool post is in the way necessitating the use of a long, slender, springy tool. The tool is provided with an adjustable friction arm riding on the head slide, which prevents vibration of the tool in operation at any speed. The cutting tool is made from round or square stock, and the tool can be turned in any position, to cut on bottom, sides or top.

These attachments are now in use in the most exacting shops, and reduce the cost of die work, approximately, fifty per cent. Large dies are handled as easily and successfully as small dies, there being no tool post in the way.

The attachment is made in three regular sizes. No. 0 taking ⅜-in. to ½-in. round shank tool; No. 1 taking from ½-in. to ⅝-in. round shank tool; and No. 2 taking from ⅝-in. to ¾-in. round shank tool. Each size is furnished with two cutting tools, sharpened and ground ready for use. The net weight of the attachment is 5 lbs.

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PRINCIPAL CONTENTS

The Exchange Situation

VARIOUS views are taken in regard to the exchange situation. The man who has a shipment coming from United States that he must pay for, realizes that to him it means a straight increase in his purchase price of 10 per cent. or so, depending on the exchange rate on the date of delivery. To the man who is selling an article in competition with a similar line sent in here from United States, it means an added protection of ten per cent.

Britain's coinage is being more closely sliced than the Canadian, but to all intents and purposes Britain is not worrying about the matter, and is taking no steps to have the matter righted.

The "Wall Street Journal" takes this interesting view of the situation:—

"The United States is the only country that is not alive to the international situation. England is getting away with the world's business. The fall in sterling gives her a 25 per cent, protection against imports and a 25 per cent. stimulus to exports, but back of her is a country with still lower exchanges, and England, as mistress of the seas, is gathering up the cheap goods that Europe is starting to pour forth and is passing them over the world at handsome profits. She buys low in Europe, and will soon be selling at high prices in the States.

"In three years England will be the commanding commercial and trading power of the world, and as she stood as the bulwark of democracy and freedom, we shall not regret it. I rather think she is entitled to all she can get. She has been on the seas and in international trade for a long time, and she knows markets over the earth as does no other nation."

United States exporters recognize the situation. They can see that their sales are harder to push with the exchange handicap against them. Many of them, irrespective of any national move, are taking steps to have accounts in various countries where payments can be made at par in the currency of these lands.

It's small advantage to United States to have its money worth more than the money of other nations when outsiders simply stand back and wait for conditions to right themselves. Meanwhile the world will be inclined to buy where its dollar, its pound, or its franc will carry the greatest amount of weight in paying bills.

Graded Certificates

INFORMATION has been published concerning the Act grading certificates for a sufficient length of time to enable an estimate as to its reception amongst the engineering fraternity. Generally speaking, opinion seems to be favorable to the Act, although some objections are raised to individual portions of the Act and the regulations respecting it.

The point to which the greatest exception is made is perhaps that relating to the qualifications for a first-class certificate, both as regards practical experience and technical knowledge. At first glance the qualifications may seem somewhat severe, but in no other way can the status of stationary engineering be raised so effectively. The first-class certificate should be one well worth while having, and to achieve this, it must be a fairly hard thing to obtain.

When employers of engineering skill learn that the standards set by the Ontario Board are high and demand genuine worth on the part of the engineer, it will be materially to the benefit of the stationary engineer himself. His pay envelope will undoubtedly be fatter and his reputation more in keeping with his worth.

It may be argued that the first-class certificate will only be available to the limited few and that injury will be done to the older men of the present engineering world. This may possibly be true, but a remedy should not necessitate the lowering of the standard but rather a readjustment of the graded plant requirements. This could be done easily by the Board under Order-in-Council as soon as it were found necessary and with the experience gained during the coming year it will be more fitting to discuss this question later on.

It might be well emphasized that although the engineer cannot obtain a first-class certificate on his application form, much depends upon the manner in which his application form has been filled out, whether he obtains a second or third-class certificate. The application blanks have been issued for a definite purpose and this purpose, briefly stated, is to give the engineer every opportunity to obtain the highest grading possible.

Men Or Mushrooms?

IT is a very easy matter to walk along any of the downtown streets of our cities and see in the shoe-shine parlors a string of boys and young men getting their shoes shined. Very often included in the string are a number of youngsters in short trousers, and the percentage of those who have still to have their first shave is fairly large.

Now, shining boots is all right. Not a word against that. But what is the matter with these young dandies shining their own shoes?

If shoe-shining were confined to those who were not able to do the job for themselves, there would not be work for more than a corporal's guard of these foreigners in every community.

But there they sit, lads fourteen, fifteen and sixteen, generally with a cigarette butt growing in the side of their face, with a foreigner prancing around shining shoes for them.

Small wonder if one were minded to ask if we are raising a generation of men or a crop of mushrooms?

Are Getting Results From Their Efforts

Men Appreciate a Share in Direction of Industry—The Position of the Engineer in the Community

R. W. GIFFORD, of the Massey-Harris Co., spoke before the Toronto Section of the American Society of Mechanical Engineers on February 2, and gave some interesting facts relative to industrial councils and welfare work.

About one and one-half years before the close of the war a change in management occurred, and Thos. Findlay was made president of the company instead of vice-president as formerly. A need for more amicable relations was apparent, and Mr. Findlay determined to build up for his firm a reputation in labor matters equal to that obtained by the implements manufactured.

No matter what system is adopted by any industry a few main facts must be clearly recognized and rigidly adhered to. The most important of those upon which the Massey-Harris Company base their work are as follows:—

A square deal for every employee, and each case to be considered solely upon its own merits.

A fair day's pay for a fair day's work.

Reasonable working hours.

Pension systems, welfare work and opportunities for financial interest in business are also important.

The scheme of organization of the industrial councils, the welfare work, the cafeteria system and other phases of the work were all dealt with by Mr. Gifford and the interested reader might refer to CANADIAN MACHINERY for July 31, 1919, for further details.

Remuneration continues to be a live subject in any industry and naturally has occupied the time of the councils to some extent. Results are seen in the following figures. The *Labour Gazette* estimates an increase in the cost of living of 66 2/3 per cent. The average wage increase over the whole firm is in the neighborhood of 105 per cent. Hours have been decreased, and with success, for when the nine-hour day was first put into effect 98 per cent. of the estimated lost output was made up.

Mr. Gifford illustrated his paper by means of lantern slides showing various phases of the work, and also by means of a moving picture illustrative of the cafeteria. A discussion followed, in which a number of those present took part.

Calvin W. Rice, secretary of the Society, was the second speaker of the evening, and throughout his talk emphasized the changing relation of the engineer to the public, and especially the importance of his taking part in the affairs of the nation and of the municipality in which he lived. Heretofore the engineering societies, without exception, have, primarily, focussed their activities on the advancement of science, and in particular that part of it which appealed to the branch under consideration. In this was seen the reason for public indifference to the engineer, his work and his remuneration, and it rested with the engineer himself to find a remedy. If the engineer, through his societies and by individual effort, would make himself more active in civic and national affairs, recognition would come almost in proportion to his participation.

In passing it was remarked that while the cost of living had advanced so greatly, the compensation of the engineer in United States Government employ had only advanced 4 per cent., and in municipal employ, 12 to 14 per cent. The local engineering societies should affiliate with the local Boards of Trade or Chambers of Commerce, etc., and should take an active advisory part in municipal government. The ideal organization would also include student organization from the universities, these to be affiliated with the local bodies, and these latter in turn with the national societies. Mr. Rice gace much information relative to the functioning of the engineering organizations in the United States, and spoke of the war work carried on by their assistance.

How the Locomotive Whistle Came to Life

A Musical Instrument Maker Solved the Problem—Horseback Rider Used to Precede the Locomotive

By F. A. McLEAN

SURROUNDED on every side by wonders of the mechanical and electrical world, the majority of people are disposed to take them for granted and regard them more or less as if they had always been. As a matter of fact, there is usually an interesting story behind the invention of most of the things that are now considered essential to our everyday life.

How many people, for instance, could tell offhand who invented the locomotive whistle or know that it came into being like many other epoch-making inventions and discoveries as the result of an accident. An apple falling on the head of Sir Isaac Newton, as he lay under a tree, is said to have started the train of thought which led to the promulgation of Newton's law. Bell stumbled onto the telephone accidentally while working on an apparatus to improve the hearing of the deaf. The phonograph was born while Edison was working on an entirely different invention. A lazy boy gave us the first automatic valve motion for a steam engine, while Elias Howe is said to have conceived the sewing machine needle in a dream, so that it is not at all strange that the invention of the locomotive whistle was also brought about by an accident.

On May 4th, in the year 1833, Stephenson's locomotive the "Samson"—a successor of the famous "Rocket"—ran into a farmer's wagon containing fifty pounds of butter and eighty dozen eggs, on a level crossing between Thornton and Bagworth, England. Had the high cost of living been a topic of discussion at that time, or had butter and eggs been worth as much in those days as they are now, perhaps Stephenson's career as a railroad builder would have been cut short.

At any rate, as a result of this spreading of butter and eggs around the landscape (and perhaps as an aftermath of the death of William Huskisson, a Cabinet Minister, who was killed by Stephenson's Rocket on September 15th, 1830, and thus had the unfortunate record of being the first man ever killed by a locomotive) a meeting of the directors of the railroad was called to see what steps could be taken to prevent accidents in the future.

In 1825, when the Stockton and Darlington Railway was opened, for the first part of the trip, a man on horseback had preceded the locomotive, warning people to get out of the way, but during the latter portion of the trip Stephenson ordered him out of the way and speeded his engine up to fifteen miles an hour. The Samson being a heavier and more powerful locomotive than the famous Rocket and other earlier models, sending a mounted man ahead of it was now out of the question, so Stephenson's suggestion that a whistle blown by steam could be used, was welcomed by the directors.

Acting on Stephenson's advice, a musical instrument-maker in the town of Leicester produced a steam trumpet which was about eighteen inches long and about six inches across the bell, and resembled a huntsman's horn. This horn was tried out before the board of directors and accepted. It must have had a weird sound, and no doubt was effective, as we are told that the Reverend Sydney Smith, a witty divine, was wont to say that "Stephenson's whistle always reminded him of the squeal of a lawyer when the De'il first got hold of him."

MARKET DEVELOPMENTS

Runaway Market Coming in Steel Trade Soon?

Prices Mounting Rapidly and Many Sales Going Through Record New High Marks in Selling—Inquiries Coming in Much Better for Machine Tools—Scrap Iron Comes High

NO person in the trade would care to become responsible for the prediction that we are approaching a runaway market in the steel industry, but it does look as though the agency were lacking that at this time could come forward and put a peg in the premium market. Quotations for odd lots are getting farther away from a cost plus basis. It is very often a case of what can be secured, based largely on the urgency of the sale, and the ability of the seller to deliver the goods. One report has it that plate tonnage has been placed by Canadian buyers as high as 4.50 Pittsburgh. Local warehouse prices were also advanced this week on plate and sheets.

Machine tool inquiries are reported as improving this week. It had been thought that the exchange situation was holding up considerable business, and that inquiries were held back pending some improvement in this. Apparently this is not the case, as several dealers say it does not stop sales. The only effect is to give Canadian material and goods a preference and to boost the sale of used machinery.

An announcement is made of an increase in American-made carbon drills, and it is not unlikely that the Canadian-made article will find it necessary to take similar action.

Scrap iron is in great demand at present, and it is doubtful if much of this could be secured under $40 a ton, which is a fancy price. Some of the dealers state that they look to see it worth as much as pig iron. Foundries want it, and there is a scarcity. During the war a great deal of it went out of the country for keeps in the shape of base plugs, etc., and much of it was used in war machinery.

EXCHANGE RATE BOTHERS TRADE IN THE MONTREAL MACHINE FIELD

Special to CANADIAN MACHINERY.

MONTREAL, February 5.—The all-absorbing subject of the present day appears to be the complex problem of exchange and its effects upon the business of the country is one that cannot but impress those who in any way have transactions with American houses. It is undoubtedly true that much business has been diverted to Canadian firms who are in a position to take care of the needs of the buyers in this country. Not only is it a big handicap in carrying on business but it has the tendency to hold up contemplated expansion in many directions. Where material must come in from the States great difficulty is frequently met in getting the purchaser down to the point of closing a sale, as the high exchange rate means considerable additional outlay in the buying of equipment. Action has been taken in many cases by American manufacturers to overcome this objection, and bank accounts have been opened in some of the leading Canadian cities whereby it is possible to meet the requirements of those in need of material without assuming the burden of the excessive exchange. While the present conditions are, in a measure, to be regretted, there is, nevertheless, a favorable side to the problem. Just this week CANADIAN MACHINERY was approached by a representative of a machine tool house in the States, as to a suitable local well-equipped plant that would be in a position to take care of their Canadian and British trade, by manufacturing here, thereby overcoming the question of the high exchange rate and duty charges.

Acute Condition in Steel

There are still no signs of relief in the general steel situation, and consumers are still pressing the dealers for delivery of materials, but the dealers in turn must abide by the wishes of the producers, who are unable to adequately meet the present trade requirements. The warehouse conditions are going from bad to worse, and little can be done to replenish supplies as material delivered can find a market almost before it is out of the cars. The situation is becoming more and more acute, and the existing tension will be greater before it is less. The general conditions are reflected in the higher base prices effective this week on plates. While $3 is quoted as the ruling figure, the leading mills have only advanced to $2.75, but this price only applies to delivery at mill convenience, which may be reasonably placed at from six to eight months. If a customer must build a tank or a stack immediately he could probably get the desired material by paying a good premium over quoted prices. This is by no means an uncommon procedure. Local dealers are deferring any advances but intimate that those quoted can only be considered as nominal and must only be taken as a guide for indefinite delivery. The clouds of uncertainty are becoming denser every week, and looking into the future is becoming more and more difficult.

U.S. Firms May Manufacture Here

An interesting condition that is arising out of the seeming complexity of international exchange is the attitude taken by some American business houses to solve the problem of diverted orders that would, in the ordinary course of events, be placed with United States firms. It was announced recently that some American manufacturers were taking steps to counteract the heavy exchange rate by dealing with the Canadian buyer direct. This method of striking a balance has apparently given note to another, and this is exemplified in the scouting process of some American tool manufacturers in the effort to find some local engineering plant that is equipped to make their line. One American firm has a representative in Montreal this week casting about with this purpose in view. There continues to be a fair demand for general purpose equipment, but as one dealer stated, the uncertain delivery has impressed many firms with the imperative need of making the best machinery on hand. The slight revival in the demand for used tools is a barometer of current conditions. The market is showing the aftermath of war in the greater distribution of British-made tools, particularly of the smaller variety of machines, accessories and supplies.

Scrap Metal Market

There is still a passive condition exhibited in the old material market, with business on the quiet side. Considerable activity is shown in local sales, the foundries taking regular supplies for current use. No attempt is made to accumulate large supplies, and as a matter of fact this could not very well be done as there is little surplus of cast iron scrap. Dealers are holding to prices quoted, but state that same should be taken as nominal quotations only.

MANY INQUIRIES FROM WIDE FIELD

Business Reported as Very Satisfactory —Some Prices are Going Up Again

TORONTO.—Improvement is reported in several lines of the machine tool and supply business. Inquiries, according to reports received by CANADIAN MACHINERY in this district, are coming in from a well-distributed line of industries. Some are for new concerns that are just commencing business. They are in the market for a long list of machinery. In other cases existing concerns are adding to their equipment. It all helps to make up a good-sized volume of inquiries and orders.

Some of the dealers appeared to think that buyers were holding back during the last week or two, waiting, among other things, to see if anything were going to come of the exchange situation that would make prices any more favorable for them. "Exchange is stiff," remarked one manager to-day, "but it really is not a determining factor in the placing of business. I cannot recall an instance offhand where a customer has declined to buy because the exchange has stood in the road. There is no doubt, though, that it is helping the sale of Canadian and used machinery."

There is talk of some price advances in the supply market. The lines that may be changed are hack-saw blades and chain blocks, although no action has been taken yet.

Prices are Moved Upward

Sheet and plate were both marked up in the local warehouse lists this week. Sheets, No. 28 box annealed, are now selling at 8c per pound, and No. 10 at 7.50. Plates, ¼ inch and up, are now priced at 6.50, and 3-16 in. and up, 7. These prices are simply a reflection of the higher prices being asked at the mills, where all base prices are up above the high prices of a week or so ago.

Even at the advanced prices that are prevailing the mills are not showing any tendency to accept business. This rather does away with the theory that was held by some of the dealers a while back that mills were refusing business, waiting for higher prices to prevail. If they had been doing this they would have a great chance to come out into the market now and sign up all sorts of business at a very respectable premium. As a matter of fact it is not possible to book business for plates, sheets or tubes at any price. It had been held for some time that premiums would bring out mill capacity when they were offered, but there is nothing in sight to substantiate such a view. There are plenty of rumors around as to the prices that are being offered and paid for decent shipment of material. Of course there must be something allowed for the imagination in the spreading of these reports, but CANADIAN MACHINERY heard of one case this week where as high as 4.50 base Pittsburgh was paid for plate.

There has been a change made in the method of selling cold-rolled steel. Formerly it was sold at a list price plus, while now it is quoted at 6.25 with extra for sizes.

Warehouses report that there are many inquiries just now, and that there is no difficulty in disposing of all the material they are able to secure from the mills.

The Small-Tool Market

Makers of American drills have advised the trade of an increase in the price of carbon drills, and it seems likely, according to reports in the trade, that Canadian makers will make a similar move. American carbon drills have been sold here at 50, 10 and 5 off, while the price now is 50 off. The Canadian-made drill has been sold at 40, 10 and 5 off, and although there is no announcement out yet, it would occasion no surprise were the price to go to 40 off.

Dealers report that business is exceptionally good and that inquiries and sales are coming from a large number of industries. Most of the business is in the form of small orders, and in one sense these small orders are more desirable than the larger ones because in the latter there is apt to be a persistent demand for some special price arrangement in order to land the business.

The Canadian National Railways are out with a very large specification now, covering some thirteen pages, composed mostly of milling cutters. This is for the purpose of tooling up the equipment that has been placed in the St. Malo shops.

The Scrap Metal Market

The scarcity of cast iron may be said to constitute the only feature in the scrap metal market this week. The foundries all over the country are after it, and one dealer made the prediction that he would not be surprised to see scrap iron going higher, or as high as pig iron before very long, and pig iron is quite a respectable price, too. This condition is largely an outcome of the war, as before that there was always plenty of scrap iron in the country. During the war, however, there was a very keen demand for this line as it was used for making base plugs, and lots of it went into war machinery, etc. The result was that the country was raked fine of its cast scrap, and there has not been a supply coming in since the war to level off things. It is doubtful if the dealers who have any scrap could be induced to sell it under $40.

POINTS IN WEEK'S MARKETING NOTES

Pittsburgh advices state that a wide variety of prices are being quoted and that prices are being rapidly advanced in some quarters. A runaway market is believed to be at hand owing to lack of stabilizing influences.

The U. S. Steel Corporation have announced a 10 per cent. increase in wages to common labor and adjustments in keeping to skilled labor. No present intention is evident to adding this to selling prices.

Transportation has been the chief factor in holding down production for the last fortnight, from the mines, by-product coke ovens and steel mills.

Toronto warehouse prices for plates and sheets were advanced again this week.

It is possible that cast iron scrap will reach a price as high as pig iron. The country was raked clean of this kind of scrap during the war, and the gap has never been filled since.

Makers of American carbon drills announce an increase. They have been selling at 50, 10 and 5; the price now is 50 off. Canadian makers may announce an increase, but nothing is known definitely yet.

The Canadian National Railways have sent out specifications for a large order of milling cutters for the St. Malo shops.

Inquiries are showing a decided improvement for machine tools, the inquiries being from a wide field and various lines of industry.

BELGIANS HAD BUSINESS TO PLACE BUT WANTED IT ALL "AT A PRICE"

Special to CANADIAN MACHINERY.

NEW YORK, February 5.—While the Eastern machine-tool markets continue fairly active, no new projects of importance have come to light in the past week. There is continued buying by some of the large interests such as the General Electric Co., American Locomotive Co., Willys Corporation, and other companies that have been active buyers for some weeks past.

An important consolidation of ship repair interests has been effected by the Lord Construction Co., New York and the Weehawken Dry Dock Co., Weehawken, N.J., under the name of the Lord Dry Dock Co., which has a capitalization of $10,000,000. A new dry dock and ship repair plant will be constructed, plans for which had been under way for some time by the Weehawken Dry Dock Co. It is planned to have the plant ready for service in eight months. Equipment for various metal and woodworking shops will be required.

The French commission sent to the United States to make selections of machine tools from the surplus stocks of this Government, has arrived, and will purchase up to $25,000,000 worth of such equipment. Financial arrangements have been made whereby French 10-year bonds will be deposited in payment. The commission is made up of ten persons, who will remain in this country until their work is completed.

A Belgian commission, headed by Lieutenant Jean Jean, has been in this country for several weeks on a similar errand and has been only partially successful in finding the equipment it desired. This commission came with lists of tools desired by various Belgian manufacturers, and the tools which the Government had to offer did not completely fill the requirements. After the Belgians had selected from the Government surplus all of the tools that their countrymen could use, there still remained unsatisfied requirements totalling about $2,000,000 in value. The War Department asked American machine-tool manufacturers to make bids on this equipment, and indicated a wish that the American manufacturers sell at prices approximating those which the Government had quoted. As these prices were only slightly in excess of the 1914 valuations of such tools there was a lack of response from the American manufacturers. As a matter of fact only two offers were made by American manufacturers and these included commissions which the American manufacturers believed were due to their Belgian agents if any such transaction was entered into. Consequently the Belgians will return home with considerable equipment still to be bought, and the belief prevails in Washington that most, if not all, of this equipment will be bought in Germany.

The War Department has disposed of a considerable part of its war surplus. Sales in 1919 amounted to $4,979,633.84, which represented a recovery of 59 per cent. of the purchase prices. The total sales of all commodities during the past year by the Director of Sales office for the War Department amounted to $552,748,555.60, an average recovery of 73 per cent. of the cost price.

RUNAWAY STEEL MARKET HAS BEEN STARTED BY INDEPENDENT INTERESTS

Special to CANADIAN MACHINERY.

PITTSBURGH, February 4.—There has been another and radical change in the price outlook for steel. The prospect that the market would be stabilized by the independents on some regular basis has already practically disappeared. The independents had previously renounced Steel Corporation leadership by refusing to sell at the March 21 or Industrial Board prices, to which the Steel Corporation has adhered, but there remained the possibility that they would advance merely to the January 1 prices, those ruling before the Industrial Board reductions, or even to the war control prices, and stop there.

It has been made clear in the past week that the independent producers are not doing anything of the sort. They are quoting a wide variety of prices, while some are not quoting any prices at all, indicating clearly that they are waiting for higher prices still to develop.

Plates, bars, wire products, Old Country goods and sheets have all sold at higher than the war control prices, in larger or smaller quantities. A common mill price for wire nails is $4.25, against $3.50 under the war control. Plates in moderate-sized tonnages have sold at 3.50c to 4c, against the war control price of 3.25c. Bars have brought approximately the same prices, the war price having been 2.90c. Sheets have shown a wide range of price, mill sales being made up to 6c, when the war control price was 5c, and the Industrial Board price, at which the Steel Corporation sold its first half output, is 4.35c.

Runaway Market

These developments mean not that a runaway market is likely to come, but that a runaway has already started. When there is demand in excess of the offerings, when prices have departed from a stable and easily quoted level, and when producers show no disposition to hold prices down, it is a runaway. Prices will advance until buyers can no longer pay advances, and then there will be the reckoning. It is quite impossible to attempt to predict how long the runaway will last, for that depends not merely upon the actual relation between requirements and offerings, but also upon what is in the minds of buyers, for the buyers may help to put the market up on themselves. They have already done this, indeed, for some have made bids to mills in hopes of tempting them to enter orders, and have shown that they overrate the demand prospects. They are, for instance, reckoning upon a railroad raise this spring and summer far in excess of what is likely to develop. The railroads are not going to be really large buyers, at least at the outset, when the Government control is relinquished March 1.

The runaway may be over by next July or it may last through next winter. The end is hardly likely to come at an intermediate time, for if the market had strength enough to get through the summer it would presumably be able to get through the fall without difficulty. The extent of the runaway is equally in doubt. The 1899 runaway saw maximum advances over the low points of 1898 as follows: Sheets, 86 per cent.; shapes, 125 per cent.; plates, 175 per cent.; bars, 175 per cent.; billets, 175 per cent. The outcome of the runaway was unfortunate, and since then the steel manufacturers have endeavored to avoid a runaway, except that in 1917 it was only the Steel Corporation that endeavored to hold prices down, the advances by independents being stopped eventually by the prospect of Government price control, afterwards realized.

Wage Advance

Last Friday the United States Steel Corporation announced a general wage advance, effective February 1, amounting to 10 per cent. in the case of common labor, with adjustments in keeping for skilled labor. Most of the large independents have already announced a corresponding wage advance, and all will necessarily have to make the advance. It is interesting to observe that at this time, while it is the independents that advance steel prices, it is the Steel Corporation that takes the initiative in advancing wages, and the Corporation has since announced that it has "no present intention" of advancing prices in connection with the wage advance. Even if it did advance prices at the same time as wages, it would be out the wage advance as to approximately a half-year's full output, as it has sold fully that amount at the March 21 or Industrial Board prices.

The war period wage advances began with that of February 1, 1916, and ended with that of August 1, 1918, there being afterwards, October 1, 1918, what amounted to a wage advance for men working more than eight hours, as the basic eight-hour day was then instituted, time beyond eight hours being rated time and a half. The common labor rate in 1915 was 19 cents an hour, the successive advances carrying the rate to 42 cents, while the eight-hour day made the actual pay for twelve hours' work fourteen times 42 cents, $5.88, or about 49 cents an hour for the time actually on duty.

The present 10 per cent. advance raises the basis rate for common labor to about 46.2 cents an hour, making $6.47 for a twelve-hour day, against $2.28 in 1915, or 184 per cent. advance, the pay being almost tripled. The ten-hour day is increased from $4.62 to $5.08, against $1.90 in 1915. The amount of twelve-hour labor has been further reduced in the past few months, more men working ten hours and eight hours than formerly, and possibly it is the expectation that the twelve-hour day can gradually be eliminated altogether. As there has been a fair supply of labor in the past few weeks it is possible that with the present wage advance there will be such accretions as will enable more work to be put on the shorter hours.

Production

Production has increased very slowly, if at all, in the past fortnight, the restraining influence now being insufficient transportation, which has prevented any further increase in Connellsville coke output for about a month, and has enabled the by-product ovens to operate only a trifle better, while it has also threatened finishing mill operations by forcing finished product to back up against the mills. Winter weather should be past in a very few weeks, however, and then the railroads will undoubtedly function much better. While much is being said about the railroads needing more cars, and about many cars being out of repair, the main cause of transportation being slowed down is the effect of bad weather upon the working forces. The weather will correct that, and it is thought also that many men will work better when the lines are transferred from Government to private control March 1.

Pig Iron

The pig iron advance that was interrupted more or less by the holidays has been resumed in full force. Foundry and basic have advanced to $40 valley, and Bessemer to $41, malleable being $41.25. In foundry and malleable the furnaces have practically nothing left to sell but second half output, and those that are now selling for that period assert that they are merely accumulating "backlog" business, thus presaging further advances. The sellers seem to have things entirely their own way, and how long this condition will continue is problematical.

U. S. SCRAP METAL

The scrap market has been particularly active during the past week and prices in some cases have made considerable advances. An interesting feature is seen in the advance in No. 1 machinery scrap, which at centre has advanced in price above pig iron. Following are reports from various U. S. centres:

PHILADELPHIA.—The activities of the small buyer have served to maintain the strength of the local market. Several thousand tons of heavy melting steel sold to one customer for $26.50 and 1,000 tons of railroad malleable sold for $29.50.

BROCKVILLE TO TRY NEW SCHEME

Citizens Called in Meeting Decide to Start Campaign for New Industries

Brockville.—Local support of local industries was the chief topic of discussion at the citizens' meeting called by Mayor Lewis with an attendance of some 350 ratepayers. The institution of a campaign to raise the sum of $5,000 annually for three years to pay with an equal sum which the Town Council and Public Utilities Commission will be asked to provide for the maintenance of industrial propaganda work was decided upon by the meeting.

There is now a surplus of 8,000 horsepower in the St. Lawrence Hydro-Electric System, with which Brockville is now hooked up, and if this were made use of the chairman of the Public Utilities Commission stated that the rates would drop from $25 to $18 per horsepower. This will be utilized to attract American industries here.

In connection with the meeting it was decided to organize an investment company to sell bonds to local subscribers for the purpose of investing the proceeds in industries which decide to locate in Brockville. Mayor Lewis announced that applications had been made to Toronto for provincial funds to erect 15 houses under the housing commission plan.

PIG IRON MARKET

Heavy selling of iron for last half delivery still continues. A large tonnage of basic is being sold. Following are the reports from U. S. points:

CLEVELAND.—Large sales of foundry and malleable iron are reported to have reached a total of 175,000 tons for the last week in addition to 50,000 tons of basic at the prevailing price of $40. Foundry iron, 1.75 to 2.25 silicon, is selling at $40 furnace, although higher has been paid.

NEW YORK. — Foundry grades here also lead the market, and as in other centres purchases for second half delivery have predominated. Sales totalled 50,000 tons.

ROTATING BRASS FURNACE

Continued from page 161

to bring down the cost of melting and upkeep charges.

Since this type of furnace is new, and we have only had a short time from which to obtain operating data, we cannot get proof from actual records just what the cost of these items will be. The important fact remains, however, that the small furnace described in this paper was successful from the very first heat, and has been in daily operation without shutdown from the time the power was first turned on, and the lining does not show any appreciable wear. We are confident that, after a suitable length of time has elapsed, the power consumption and other data obtained will show that there is a great advantage to be obtained in rotating the furnace completely.

10. The rotation of the furnace not only preserves the lining and secures a low power consumption, but at the same time serves to mix the metallic charge, making it more uniform without requiring much supplementary stirring. Except in the case of mixtures with high lead content, the rotation of the furnace will sufficient mix the charge so that it is not necessary to stir same either in the furnace or in the ladle. This is quite an advantage and results in a more uniform product.

11. In the past the construction of electric furnaces has been along lines which require the use of special electrical appliances and equipment. This Booth Electric Furnace is a departure. It is entirely practical to operate it using the ordinary 110-volt single-phase service which can be obtained from most public service companies.

12. All details of the furnace equipment are rapidly being standardized so that quick shipment can be made of furnaces, as they are shipped completely assembled and the production and installation is a simple matter.

In case automatic electrode regulator control is desirable, it should be pointed out that only one regulator would be required, and this would reduce the investment cost materially.

13. In the design of large-size furnaces of this type, we have plans perfected for completing the equipment so that it can be operated using either two or three-phase alternating current instead of single-phase. This would be important in many cases where public service companies are not in position to handle single-phase loads over 75 k.v.a.

We are convinced that the time is ripe for the adoption of an electric furnace for the melting of non-ferrous metals. For melting of steel and metals requiring a higher temperature, the electric-arc type furnace has proven to be the most commercial type of equipment which has yet been developed. The disadvantage of the arc type furnace for melting metals at lower temperature has caused inventors to develop furnaces using other methods. These methods require special electrical equipment, however, which must increase investment cost. The Booth Electric Furnace has been put on the market because, as engineers, we believe that an arc-type electric furnace was practical for this purpose and could be built at lower cost than any other type of equipment, and was so simple electrically that the average brass foundryman could operate it without requiring expert handling. The results obtained to date with this first small furnace are convincing and prove that the principle of design incorporated into our equipment will be successful in securing all these advantages which are sought and claimed for electric brass melting furnaces without the disadvantage of high investment for special equipment and the necessary supervision which the same entails.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$33 00
Lake Superior, charcoal, Chicago	38 40
Standard low phos., Philadelphia	40 00-40 00
Bessemer, Pittsburgh	35 00
Basic, Valley furnace	30 00
Toronto price:—	
Silicon, 2.25% to 2.75%	47 30
No. 2 Foundry, 1.75 to 2.25%	45 95

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 4 75
Steel bars, base, Toronto	4 75
Iron bars, base, Montreal	4 75
Steel bars, base, Montreal	4 75
Reinforcing bars, base	4 75
Steel hoops	6 00
Norway iron	11 00
Tire steel	5 50
Spring steel	8 00
Band steel, No. 10 gauge and 3-16 in. base	5 25
Chequered floor plate, 3-16 in.	7 50
Chequered floor plate, ¼ in.	7 00
Staybolt iron	8 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 25
Tank plates, Pittsburgh	3 50
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 90
Small shapes under 3"	3 62

FREIGHT RATES

Pittsburgh to Following Points	Per 100 Pounds. C.L.	L.C.L.
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

		Gross.
Lake copper	$25 50	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	70 00	60 00
Spelter	11 50	10 75
Lead	10 25	8 75
Antimony	12 00	10 50
Aluminum	33 00	35 00

Prices per 100 lbs.

PLATES

	Montreal	Toronto
Plates, ¼ up	$ 5 00	$ 5 00
Plates, 3-16 in.	5 25	5 25

Price List No. 38

WROUGHT PIPES

Standard Buttweld		
⅛ in.	$ 6 00	$ 8 00
¼ in.	4 68	6 81
⅜ in.	4 68	6 81
½ in.	6 21	7 78
¾ in.	7 82	9 95
1 in.	11 56	14 71
1¼ in.	15 64	19 90
1½ in.	18 70	23 76
2 in.	25 16	32 01
2½ in.	40 37	51 19
3 in.	52 79	66 94
3½ in.	67 16	84 18
4 in.	79 57	99 74
Standard Lapweld		
2 in.	38 81	35 34
2½ in.	42 12	52 36
3 in.	55 08	68 47
3½ in.	69 00	86 94
4 in.	81 75	103 00
4½ in.	93	1 18
5 in.	1 08	1 37
6 in.	1 40	1 78
7 in.	1 83	2 32
8L in.	1 93	2 44
8 in.	2 22	2 81
9 in.	2 66	3 36
10L in.	2 46	3 12
10 in.	3 17	4 02

Terms 2% 30 days, approved credit.

Freight equalized on Chatham, Guelph, Hamilton, London, Montreal, Toronto, Welland.

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.
4½" and larger 50%.
4" and under, running thread, 30%.
Standard couplings, 4" and under, 40%,
4½" and larger, 20%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$14 00	13 75
Copper, crucible	17 00	17 00
Copper, heavy	17 00	17 00
Copper wire	17 00	17 00
No. 1 machine composition	15 25	16 00
New brass cuttings	11 00	10 75
Red brass cuttings	14 00	14 75
Yellow brass turnings	8 00	9 00
Light brass	6 25	7 00
Medium brass	7 25	7 75
Scrap zinc	6 00	6 00
Heavy lead	5 00	6 00
Tea lead	3 75	3 50
Aluminum	18 00	18 00
	Per Ton	**Gross**
Heavy melting steel	15 00	16 00
Boiler plate	15 00	11 00
Axles (wrought iron)	25 00	20 00
Rails (scrap)	16 00	16 00
Malleable scrap	25 00	20 00
No. 1 machine cast iron	24 00	25 00
Pipe, wrought	10 00	9 00
Car wheels	22 00	20 00
Steel Axles	21 00	20 00
Mach. shop turnings	9 00	11 00
Stove plate	22 00	21 00
Cast boring	10 00	11 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜" and less	15
Carriage bolts, 7-16 and up	Net
Coach and lag screws	30
Stove bolts	50
Wrought washers	50
Elevator bolts	5
Machine bolts, 7-16 and over	10
Machine bolts, ⅜" and less	20
Blank bolts	25
Bolt ends	10
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square blank	add $1 50
Nuts, square, tapped	add 1 75
Nuts, hex., blank	add 1 75
Nuts, hex., tapped	add 2 00
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent.
Set screws	40
Sq. and Hex. Head Cap Screws	35
Rd. and Fil. Head Cap Screws	5
Flat But. Hd. Cap Screws	10
Fin. and Semi-fin. nuts up to 1 in.	35
Fin. and Semi-fin. nuts, over 1 in., up to 1½ in.	25
Fin. and Semi-fin. nuts over 1½ in., up to 2 in.	10
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws list plus 20,	30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$43 00
Open-hearth billets	43 00
O.H. sheet bars	46 00
Forging billets	56 00
Wire rods	55 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$4 95
Cut nails	5 00
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 32
British Manila rope	0 26
New Zealand hemp	0 26
Transmission rope, Manila	0 43
Cotton rope, ¼-in. and up	0 80

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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Vol. XXIII., No. 7 February 12, 1920

Details of the C. P. R. Mikado Type Locomotive

By J. H. RODGERS

PROGRESS is a force no man can stay. Richard Trevithick, the first engineer to make practical use of steam as a power for locomotion, may have visualized in his mind's eye the future development of the steam locomotive, but the achievements of present-day engineering in this direction are doubtless far beyond the fondest dreams of the pioneers in this branch of science.

The Mikado type locomotives recently completed at the Angus shops of the Canadian Pacific Railway registers another mile post in the progress this company has taken in keeping Canada in the forefront of mechanical evolution. The final delivery of the initial order of 10 of these locomotives has just been made and the present program calls for the construction of four new types: a Mikado type locomotive, having a tractive effort of 56,000 lbs., two classes of Pacific type locomotives with 43,700 lbs. and 42,600 lbs. tractive effort respectively, and one of the Sante Fe type with a tractive effort of 66,000 lbs.

The design of these locomotives has been carried out by the mechanical engineering staff of the C.P.R., the construction taking place at the Angus shops, under the direct supervision of W. H. Winterrowd, chief mechanical engineer, and W. A. Newman, engineer of locomotive construction, to whom we are indebted for the data and photos accompanying this description.

While there has been no radical change in the general design of these locomotives, they being quite similar to those constructed by the C.P.R. in 1912, special attention has been given to detail design, and every effort has been made to produce a common-sense locomotive, which will give reliable and efficient service and economical in operation.

Boiler Construction

A departure has been made in the design of the boiler, which is built on the extension wagon-bottom type, a feature that gives a more pleasing appearance in the upper lines of the engine. This class of boiler, while not actually an experiment, is the first of its kind to be adopted on the Canadian Pacific locomotives. The decision to try out this type of boiler was the result of considerable investigation and careful study, on the part of the designing engineers of the company, regarding boiler proportions and constructions, every care being taken to insure ample steam generating capacity, combined with easy steaming qualities. Some of the reasons for the adoption of this particular type of boiler may be briefly stated as follows: By locating the steam dome further forward, or on the second course, the seam construction on the course adjoining the fire-box has been much simplified; the standpipe is separated from the crown sheet by a greater distance, and, therefore, is further removed from the extreme ebullitions that occur close to the fire-box section; the dry-pipe is much shorter, so that the length of the steam passage, from the throttle valve to the cylinders, is correspondingly reduced. Still another advantageous feature is the increased steam storage space thus provided, which, it is estimated, will add materially to the superheating efficiency.

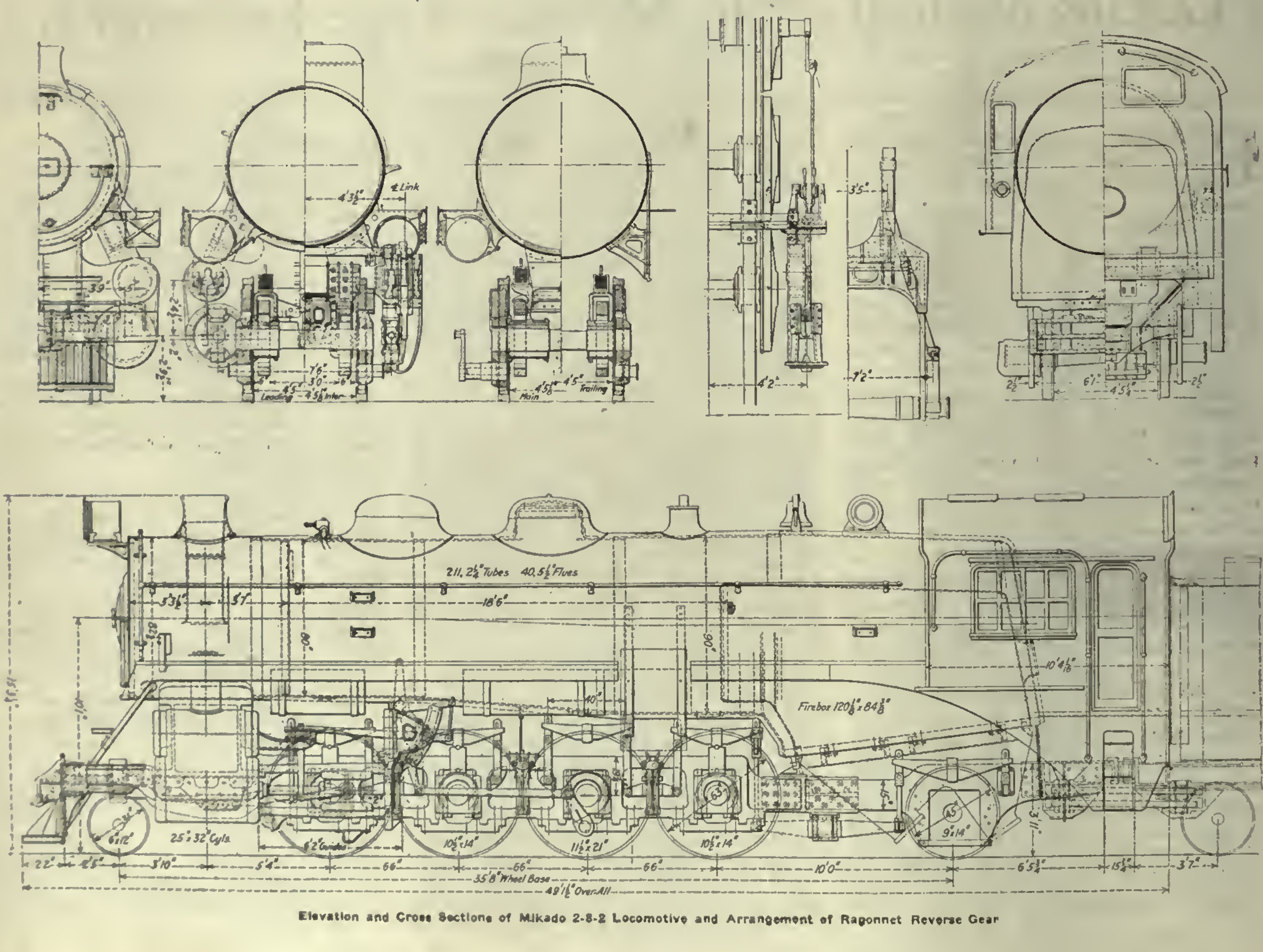
The boiler has an overall length of 38 feet 10 inches, with a diameter of 80 inches at the forward end, and 90 inches on the course adjacent to the fire-box. The capacity is based on Cole's ratio and is approximately 102.5 per cent. of cylinder requirements. The 2¼-inch tubes, of which there are 211, have a length of 18 feet 6 inches, a ratio length to diameter considered as most efficient. Another pioneer construction feature of the boiler is the use of a 28-inch barrel combustion chamber, the first of this type installed on C.P.R. engines. The mudring is of special interest, inasmuch as the cast steel ends are welded to wrought iron sides, the end portions of the steel sections being provided with drop corners to permit of through riveting for the corner fastenings of the inside fire-box sheets.

Main Frames

Experience has shown that no small amount of locomotive trouble has developed through frame breakage, and records indicate that the majority of such breakages take place immediately behind the cylinders. In an effort to eliminate, or at least minimize, this evident source of trouble, the designing engineers have provided adequate means to reduce the twisting strains apparently resulting from insufficient fastening at this point of the frame. The extension gives an additional depth of 15 inches directly back of the cylinders, and this portion of the main frame is firmly bolted to a corresponding lug on the back end of the cylinder casting, giving a total vertical bolting surface of 29½ inches.

The frames are of the single front rail type, with a uniform thickness of 6 inches, which is a little heavier than is usually found in general locomotive practice. Additional rigidity is further provided by a special wedge casting located beneath the saddle portion of the cylinder castings and between the main frame connections. The lugs of the castings are tapered, so that a firm wedge joint is secured by driving the lower casting into position and then bolting together with the vertical bolts to the saddle, and the side or horizontal bolts to the frame and cylinders. These alterations in design were deemed essential, in view of the fact that the engines will be used in sections of Canada where extremely low temperatures are frequent occurrence. The portion of the frame that carries the trailing truck is

BACK HEAD OF BOILER SHOWING CONVENIENCE OF ENGINE CONTROL — C. P. R. MIKADO LOCOMOTIVE.



Elevation and Cross Sections of Mikado 2-8-2 Locomotive and Arrangement of Ragonnet Reverse Gear

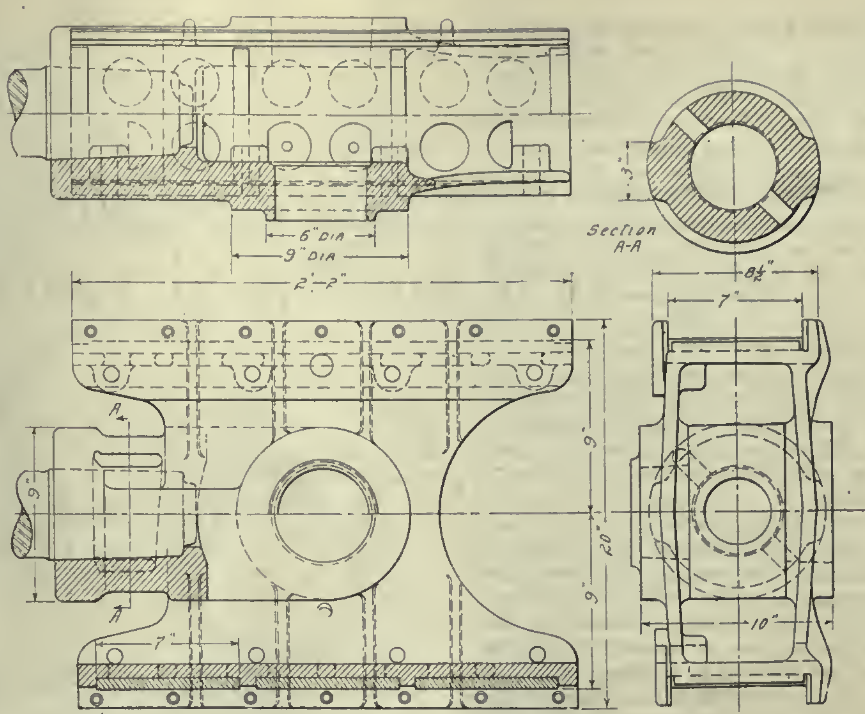
2½ inches thick, and joined to the main frame by a special offset connection.

Vaughan Trailing Truck

These Mikado locomotives are equipped with the Vaughan trailing truck, a type that has given entire satisfaction on C.P.R. engines for the 13 years they have been in continuous service. The frames for the trailing truck are located outside of the trailing wheels and are spaced 6 feet 3½ inches between centres. No radius bar is used with these trucks, the guiding motion being controlled from inclined vertical faces on the journal boxes, which bear on corresponding inclined faces on the pedestals attached to the extension frames.

Ash Pan Construction

One of the details of construction that has been given more than ordinary attention is the design of the ash pan. It is generally recognized by railroad engineers that the ultimate efficiency of an engine on the road is dependent, very largely, on this apparently minor portion of a locomotive makeup. This is particularly true in respect to those engines that may be called upon to operate in cold climates, under which conditions it is imperative to provide ample capacity and effective facilities for the discharge of the contents. The construction of the Vaughan truck, with its wide frame, allows of pan construction relatively free from flat horizontal surfaces, and with quick slopes at either side of the trailer axle for clearing purposes. In fabricating the pan the joints are made with sheet asbestos, and, wherever possible, the corner angles are placed on the exterior, so as to obtain an unobstructed surface on the inside. The safety factor has been intentionally incorporated in the construction of the pan, so that accidental dropping of hot ash or clinker is prevented by the automatic closing of the ash pan doors, the pivot supports of the doors being located back of the door centre of gravity, so that the doors are self-closing immediately the operating lever is removed.



DETAILS OF CROSSHEAD.

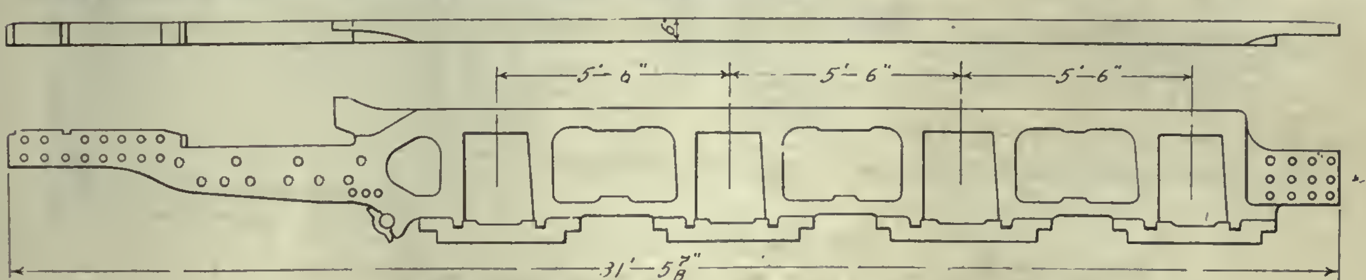

GENERAL VIEW OF THE ROD AND VALVE MOTION — MIKADO FREIGHT LOCOMOTIVE.

Moving Grates

In the past it has been found that the use of dead grates has given rise to much trouble in operation, so that this type of grate has been entirely replaced by the movable type, and the design finally adopted in these engines is of the butt finger type, 10 inches wide, and made in four sections. The centre carrier is of very light cast steel construction, and is reinforced along the lower or tension member by a structural tee iron. Every consideration has been given to design of side carriers to avoid excessive warping. These carriers are in two sections, which facilitate repairs to fire-box corners, as only one section of the grates need be removed.

Rods and Link Motion

The construction of the piston heads

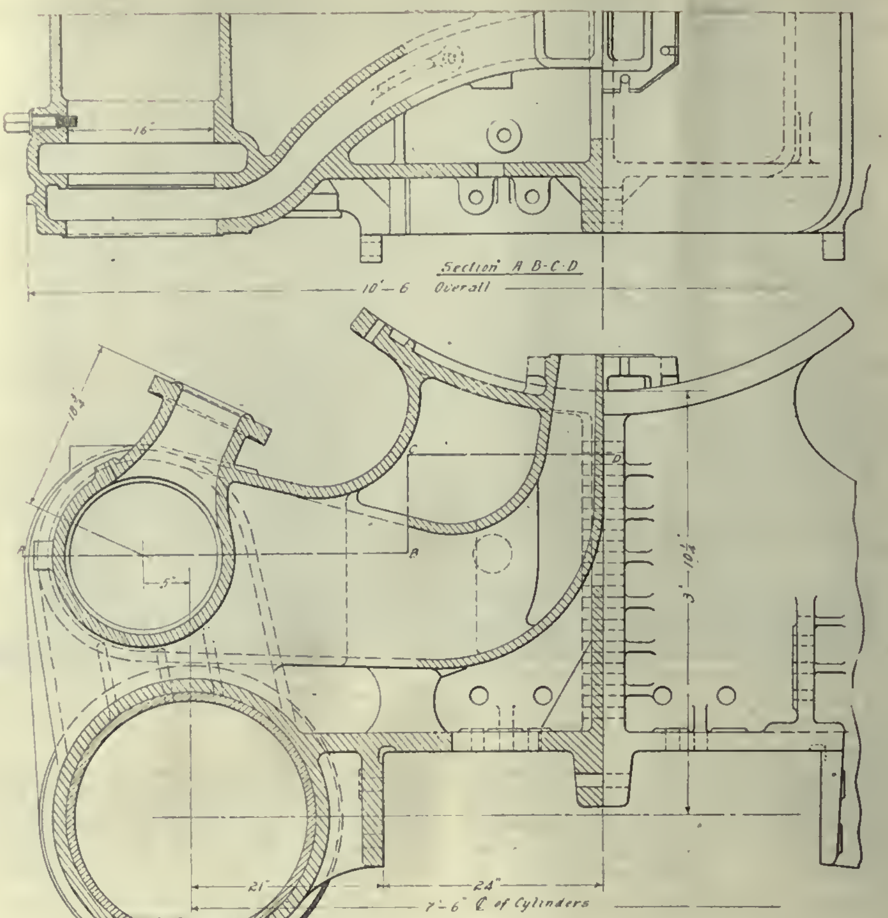


GENERAL VIEW OF THE MAIN FRAME FORGING.

differs somewhat from previous practice, as exhaustive analysis, both mathematical and by actual tests, have been made at the Angus shops to determine the specific stresses to which piston heads are subjected. The result has been a great saving in weight, as the pistons in these engines are considerably lighter than those two inches smaller in diameter, which have, until now, been accepted as standard on other C.P.R. locomotives. The cast iron crosshead, which is made in one piece, is a modification of previous standard patterns. The design provides for six removable cast iron wearing pads—three top and bottom—each of which is 7 inches long by 6¾ inches wide. These sections are kept in position by side plates bolted to the crosshead body.

An interesting detail in connection with the valve operating link motion is the change effected in linking up with the crosshead. The union link is apparently fitted to the wrist pin, but actually works on a bearing formed by a step on the inside washer, which, in turn, fits on a tapered shoulder of the crosshead body. This has the advantage of relieving the wrist pin of any thrust from the valve mechanism through the union link.

By paying particular attention to every detail of reciprocating motion a remarkable saving has been effected in weight of moving parts. These are all made of carbon steel, but are only 96 lbs. heavier than on those used on lighter Mikado locomotives. The increase in weight of reciprocating parts is approximately 5.87 per cent., while the increased piston load is 31 per cent. —a creditable achievement.



DETAILS OF SADDLE CASTING SHOWING PORTS AND CYLINDER CONSTRUCTION.

Arrangement of Control

One of the problems of locomotive construction is the arrangement of the control and operating mechanism, 95 per cent. of which is located within easy reach of the engineer or fireman in the cab of the engine. Effort has been made to obtain the most convenient and efficient layout on the back head of the boiler, so that all valves, throttle lever, lubricators, air brake control equipment, etc., would be properly located and at the same time allow both the engineer and firemen to have an unobstructed view of the water glass and the steam gauge.

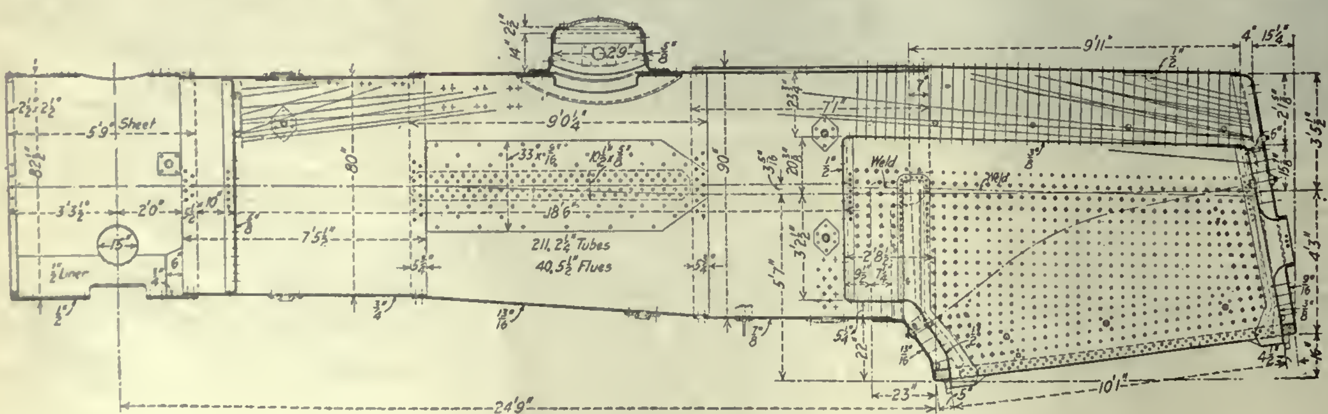
The vestibule cab is of the standard C.P.R. type, but owing to the width of fire-box it prevented the placing of the brakeman's seat in front of the fireman, as is generally the case. The cab is amply provided with wood-lined lockers for the crew's clothes, etc. Signal equipment is carried in a special wire rack located on the ceiling of the cab.

Standard C. P. R. Tender

The tender is of the water-bottom type. The tank, which has a water-carrying capacity of 8,000 Imperial gallons, is supported on a Commonwealth one-piece cast steel underframe. The coal space provides for a capacity of 12 tons, and the 45 degree slope of the back sheet insures a constant feed of coal to the front of the coal space, this feature dispensing with the use of a coal pusher. This is standard practice in C.P.R. tender construction. The swash plate bracing is arranged to minimize rivet strain.

Air Brake and Special Equipment

The air brake is the Westinghouse schedule "ET" with cross-compound



Extension Wagon Bottom Boiler for Canadian Pacific Mikado Type Locomotive compressors. Ample cooling surface is provided in the air brake piping, 2-inch pipes being used between the compressor and the first reservoir. A parasite reservoir is also part of the air system, and the pressure is controlled by a Westinghouse parasite governor.

The locomotives have a total weight of 320,500 lbs., with 235,000 lbs. on the driving wheels, which gives a factor of adhesion of 4.18. The cylinders are 25 in. by 32 in.; driving wheels 63 inches in diameter, which, with a normal boiler pressure of 200 lbs. per sq. in., gives a maximum calculated tractive effort of 56,000 lbs.

The locomotives are hand-fired and have proved exceptionally good steamers, and quite live up to the expectations of economy in coal and water.

The Art of Properly Splicing Wire Rope

The art of properly splicing wire rope is something that is not understood by very many mechanics in spite of the fact that it should be one of the things about which they should know. The result is that in many cases a faulty splice is made, and an accident of some nature or other at a later date. We received a short time ago, from the Canada Wire and Iron Goods Co. of Hamilton, a very interesting catalogue on their line of wire rope and fittings, and in this book was a short article on the proper splicing of wire ropes, which is well worth reproducing.

Before going into the article proper, however, we might add that to any one interested in wire ropes, their uses and applications, a copy of this price list catalogue for 1919 is well worth a place on the desk.

The subjects of wire rope construction, materials used, the proper method of ordering and other valuable information are all given. Certain tables of useful information are also added at the back portion of this interesting book.

To get on to the subject of the splicing of wire rope, however. Following is the method in which they present this material.

Directions for Splicing Wire Rope

Wire rope is susceptible to the most perfect splice; a smoother and better splice can be put in a wire rope than in any other kind of rope, for the simple reason that it is made with a view to this purpose. It has just the desired number of strands, namely, six, and a hemp core, which provides a place for fastening the ends. It is a plain, simple process and but the work of an hour for any one to learn.

To Get the Length of the Rope to be Spliced Endless

In most cases the ropes can be applied endless, and in such cases the ropes can be forwarded spliced ready to go on. We can furnish ropes ready spliced by giving us the exact distance from centre to centre of shaft, and the exact diameters of the wheels on which the rope is to run. This measure can be got best by stretching a wire from shaft to shaft, marking the distance from centre to centre of shaft and carefully measuring the wire.

In cases where the endless rope cannot be put on, the rope has to be put around the sheaves, hove taut by pulley blocks, and the splice made on the spot. See Fig. 1 in diagram of splices.

The Necessary Tools

A hammer and sharp cold chisel for cutting of ends off strands; a steel point or marlin spike for opening strands; two slings of tarred rope with sticks (see Fig. 5) for untwisting rope; a pocket knife for cutting the hemp core; a wooden mallet and block.

First.—Put the rope around the sheaves, and heave it tight with block and fall (see Fig. 1). The blocks should be hitched far enough apart so as to give room between to make a 20-foot splice. A small clamp may be used to prevent the lashing from slipping on the rope where the blocks are hitched (see Fig. 1). Next, see that the ropes overlap about 20 feet; about ten feet each way from the centre, as shown by the arrow lines in Fig. 1. Next mark the centre on both ropes with a piece of chalk or by tying on a small string. Now proceed to put in the splice, with the blocks remaining taut when it is necessary, but the better way is to remove the blocks, throw off the rope from the sheaves, let it hang loose on the shafts, and then proceed with the splices on the ground or floor, or scaffold, as the case may be.

Second.—Unlay the strand of both ends of the rope for a distance of 15 feet each, or to the centre strand of both ends of the rope for a distance of 15 feet each, or to the centre mark. Next cut off the hemp cores close up, as shown in Fig. 2, and bring the bunches of strands together so that the opposite strands will interlock regularly with each other (see Fig. 3).

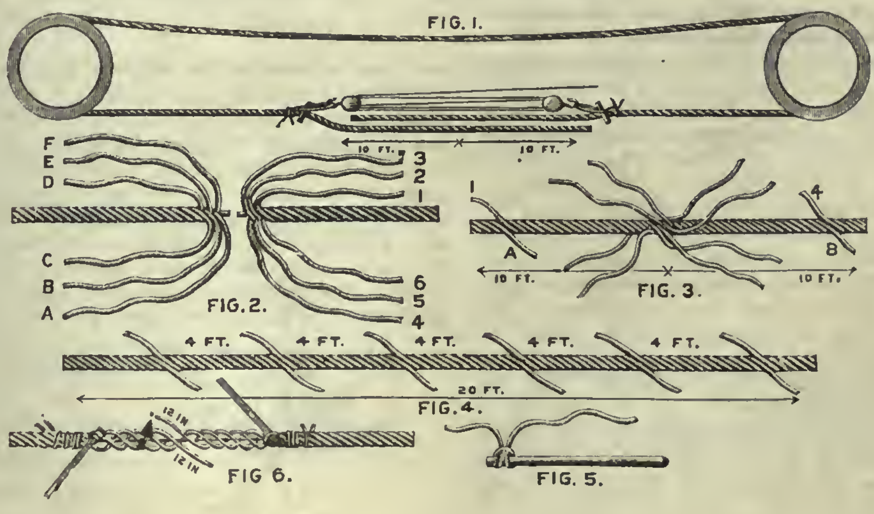
Third.—Unlay any strand A, and follow up with one strand of the other end, laying it tightly in open groove made by unwinding A; make twist of the strand agree exactly with the twist of the open groove. Proceed with this until all but twenty-four inches of one are laid in. Next, cut off A, leaving an end about twenty-four inches long.

Fourth.—Unlay strand 4 of the opposite end and follow with strand D, laying it in open groove as before, and treating this precisely as in the first case (see Fig. 2). Next, pursue the same course with B and 2, stopping six feet short of the first set. Next, with 5 and E, stopping as before, then with C and 3; and lastly with 6 and F. The strands are now all laid in with ends six feet apart, as shown in Fig. 4.

Fifth and Last.—The ends must now be secured without enlarging the diameter of the rope. Take two rope clamps (see Fig. 5), and fasten them to the rope, as shown in Fig. 6; twist them in opposite directions, thus opening the lay of rope.

Next, with a knife cut out the hemp core for the necessary distance. Now straighten the ends and drive the marlinspike under the strands (see Fig. 6), and work end into the space previously occupied by the hemp core; then twist the clamps back, closing up the rope. The ends should be laid in, side by side—that is, they should not be crossed over each other. At the point where tuck is made, hammer with copper mallets to fix the strands firmly in place. Next, shift the clamps and repeat the operation at the other five places, and the splice is made.

A portable bath cabinet invented by a North Carolinian includes tub, tank for both hot and cold water, oil heater, medicine chest, towel rack, closet and extension seat.



Interesting Operations in Machining of Elbows

By F. SCRIBER

THE ELBOW, shown in position as held by the various fixtures used in connection with the machining of the finished surfaces, is first sand-blasted and all lumps are ground off, following which the flange is drilled. The large diameter is then turned, the hole is chamfered, the flange is faced on the side next to the turned diameter and as a sequence to this the flange is profile milled to the outline shown so it will conform to the outline of the part it is to be bolted against.

Three fixtures are used to handle this part efficiently and the first operation consists of drilling the six holes in a manner as provided for by the fixture illustrated in Fig. 1.

The interesting feature of this fixture arises from the fact that the base A is merely used as a block to support the elbow, it being of cast iron, finished top and bottom only, while the portion B is in reality a template made of cast iron with six guide bushings C for locating the drilled holes, which is done relative to the boss X by having two pins D straddle loosely any one of the six bosses. Apart from this the plate B is located from the large centre hole of the elbow by means of three pins E that are caused to expand by the screw F, with hand-knob G working on their bevelled ends, these pins being held in position by screws and springs H.

With the template in position on the work the same is slipped over two pins J in the base of the fixture, thereby tying the entire arrangement together for locating in the drilling machine, this operation being performed in the usual manner, care being taken when drilling hole K directly over the curve not to force the work into a tilted position on the fixture, this being easily accomplished by keeping the hand not in use operating levels on the left side of the template.

In turning this elbow Fig. 2 advantage is taken for locating purposes of the holes previously drilled, which locate each elbow centrally under the boring head of the machine and at the same time counteract any tendency to turn under the cut, pins A enter two holes and are used for this purpose. The base B of this fixture contains two slides C which are held in place by plates D. These slides are adjustable by means of screws E and they are used for clamping the work on the periphery in a manner obvious from the illustration, it being also apparent that this fixture is clamped to the table of the machine using tongues F for locating from the slots of the same.

The cutting operations at this time consist of turning the diameter X and ing the flange with box tools, facing the end and chamfering the beveled hole, all of which are performed on a horizontal boring mill by using standard types of tools.

A difficult operation to perform is that of profile milling the outer form around the bosses and periphery, but by setting the elbow up as arranged for in the fixture, Fig. 3, this is well taken care of, and after describing the manner of holding, the operation of profile milling will be described, at which time reference to the post. The three bolts F are now put in place through the plate and work at the three holes not used to go over the spring pins, thus securely holding the formed plate to the work. We next clamp the formed plate on the curved post by tightening screw G against collar H. Spring-pins C, which heretofore were loose, are now locked by screws J, thus the whole arrangement balances well, one unit against another, making a very substantial holding

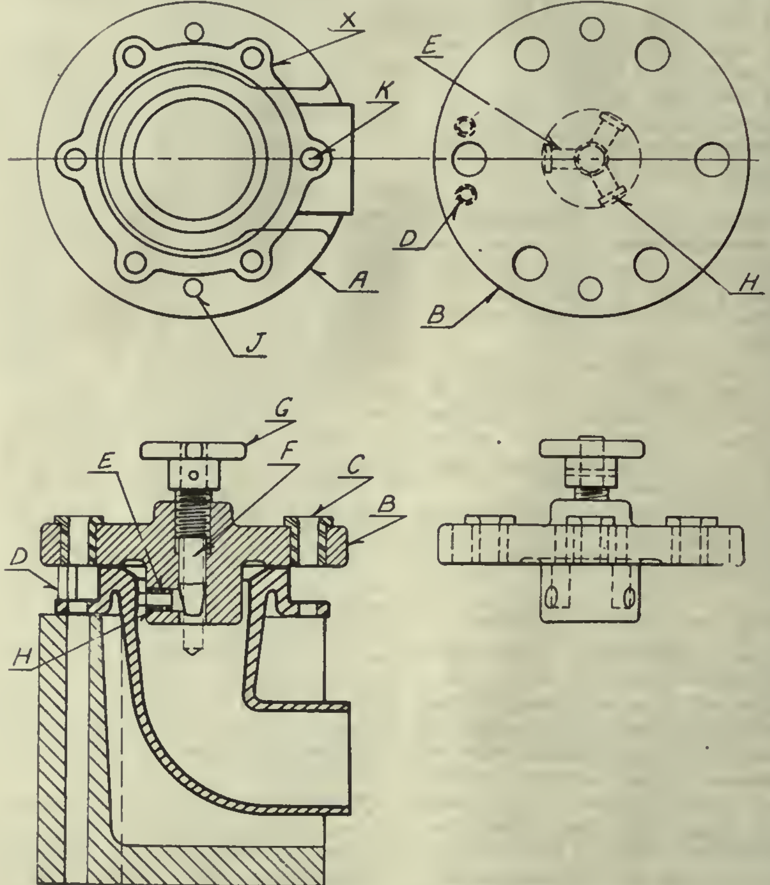


FIG. 1. ILLUSTRATING THE DRILLING FIXTURE.

will also be made to the cutter, Fig. 4.

Referring to Fig. 3, with plate A entirely removed from the fixture, the elbow is placed over the curved post B, and it is allowed to rest on the three spring pins C which have the end turned down at Z to enter three holes in the work, thus locating the same radially upon the base D. Next the formed plate A is slipped over the curved post B, a key E being used to locate the same with reference

fixture. The pin K keeps the curved post in an upright position while the base of the fixture is clamped to the table of the machine in the usual manner.

This operation is somewhat different than the usual run of profile milling inasmuch as but one spindle of the machine is used without the customary guide pin, the cutter shank being so made as to guide on the formed plate of the fixture.

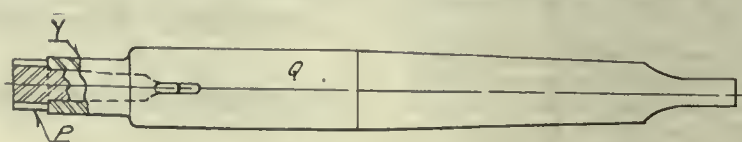


FIG. 4. A VIEW SHOWING THE CUTTER USED.

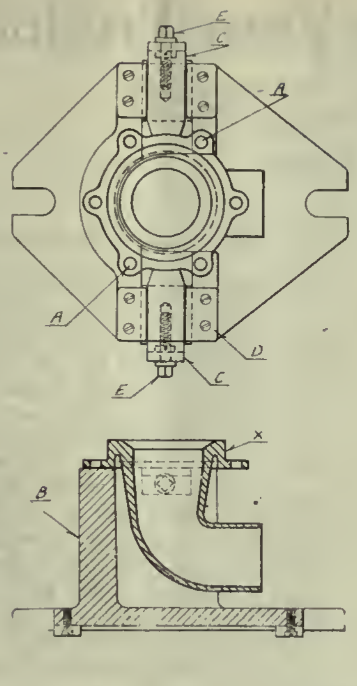


FIG. 2. DETAILS OF TURNING FIXTURE.

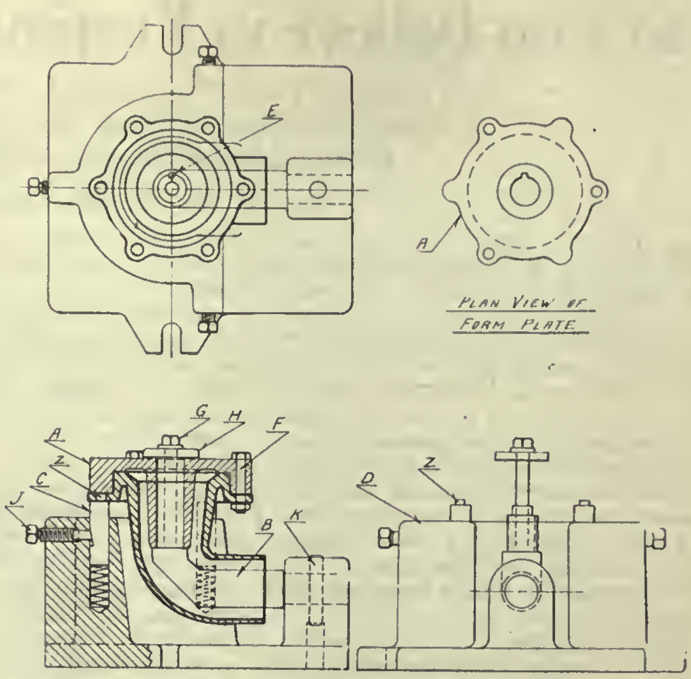


FIG. 3. DETAILS OF PROFILE MILLING FIXTURE.

Referring to Fig. 4, the cutter proper P is of the type which is sharpened by grinding on the face of the teeth; this is tongued into the shank Q. The portion of the shank Y is held in contact with the formed plate while the cutter is revolving and milling the outline of the work, the desired contact with the formed plate being maintained at all times by the operator feeding the two handles of machine simultaneously, causing the table to travel in a transverse and longitudinal direction just sufficient to provite a good cutting action.

This entire tooling arrangement is one in which variety and novel construction are combined in set-ups on standard machines to produce a high-class interchangeable product in a very proficient manner, leaving very little to chance.

PROTECTING THE LATHE CENTRE

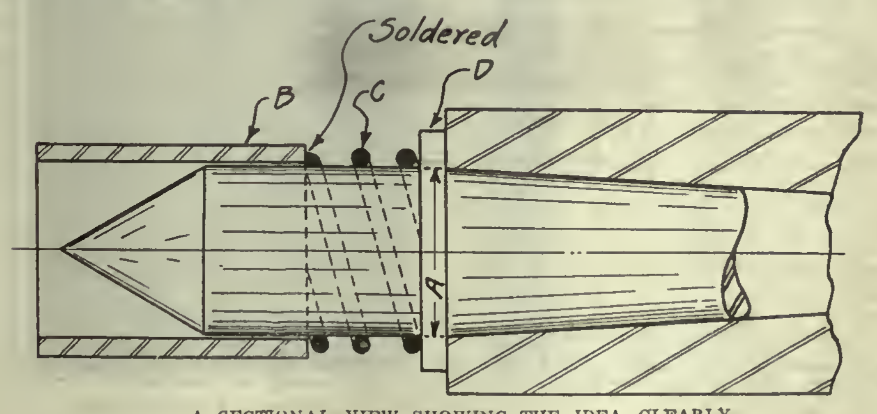
By Harrison Jenkins

No doubt readers in general will agree with the writer when he mentions that in operating a lathe it is an annoying thing to find that as you are placing the work in the chuck, your arm or elbow comes in contact with the sharp point of the tailstock centre.

Lathe operators in particular no doubt have experienced like trouble, yet any danger (for such it is) can be easily avoided and overcome if one takes the time to discover some little idea to eliminate the bugbear, and the following idea, though very simple, certainly overcame the trouble already discussed.

The writer merely made a centre with a straight portion, A, on which he slipped a piece of pipe, B. He then soldered a small spring, C, to one end of this pipe as shown. The washer, D, was merely placed in its position, so that the wear would come on the washer and not on the tailstock sleeve.

The idea itself is, of course, obvious, for when not in use the pipe protects the sharp point of the centre, yet when required for use, the tube easily slips back on the pressure of the work being applied.



A SECTIONAL VIEW SHOWING THE IDEA CLEARLY.

DRILLS AND STRAIGHT HIGH-SPEED TOOLS

High-speed tools, such as drills and other straight tools, should be welded by the electric butt process and in no other way. Before welding, the two ends to be joined should be planed off instead of being ground. When ground, the ends have a tendency not to join properly and the result is that an oxide forms in the weld, which invariably results in breakage when the weld is made. When welded the tool should be placed in an annealing pot filled with hot sand. When the pot is full it should be placed in an oven and brought to a temperature of 1,500 deg. Fahr. and allowed to remain in the oven at this temperature for three hours, after which the heat should be turned off and the pot allowed to remain in the oven until the tools are absolutely cold. The tools are then ready to have the burr, caused by the compression in the butt welding machine, ground off or turned off. Under no circumstances should this burr be removed prior to the heat treating process. A Western tool manufacturer, who has turned out in 1919 more than a million dollars' worth of these tools, follows this process, and the failures of his tools are so rare and infrequent as to be almost negligible. In this same plant, 700 very heavy tools were recently welded by the electric butt process and, instead of turning up the end to be united, they were ground. In the inspection room these tools were subjected to a drop test. The inspector drops the tool from the height of his waist line on to two blocks placed on the floor in such a manner that the respective ends of the tool are caught, thereby subjecting the welded portion of the tool to a sudden shock. In the case of these 700 tools, every one of them broke in the weld. This may seem like a very simple point, but it is one which the welder should not disregard.—"Welding Engineer."

A British metallurgist believes he has re-discovered the secret of the ancient Spanish armorers in producing a tarnish proof steel that even resists acids.

Do You Believe in Keeping Tab on Your Products

If You Feel Your Production Costs Excessive, Read This Article. It Illustrates Clearly How One Particular Firm Stopped Their Production Leaks, in a Definite and Simple Manner

By J. H. MOORE, Associate Editor Canadian Machinery

PERHAPS readers will have heard the story of the Irishman living in New York, who sent passage money to a fellow-countryman to come over and see the sights in the great and wonderful American city. The story has it that in due course of time the new son of Old Erin arrived at Gotham, and stepped off the gangway, where he was greeted by his old-time friend.

After the usual comments had been passed the newcomer remarked, "Say, Pat, there's one thing I clean forgot to ask you about. Is there such a thing as a system of Government practised here?"

"Sure," said Pat.

"Well, then," said the visitor, "I'll tell you right off the reel, I'm agin it—no system for me, at all, at all."

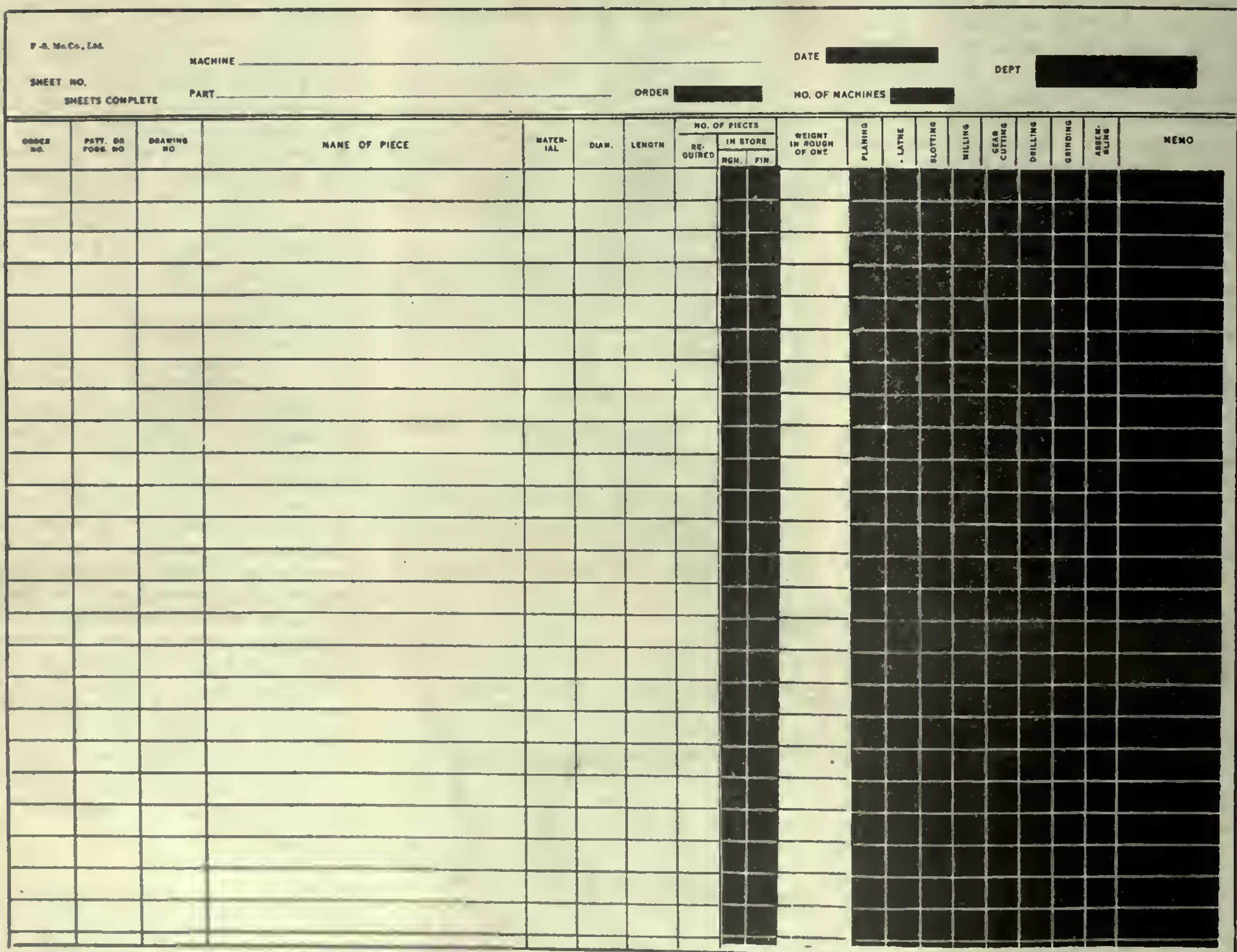
It may be a large-sized jump from such a story to the machine tool industry, but just as this Irishman had no use for system in the Government of a country, there are men in the machine tool game to-day who have no use for system of any kind in the shop or office.

Luckily, this breed is dying out, so we can safely assume that the majority of readers of CANADIAN MACHINERY are in favor of any rational system being adopted in a plant that will tend toward lower costs and greater production.

Any system to be a success must be based on a common sense fact, so if we are chasing the bugbear high cost, we must first find out the cause for the bugbear making his appearance. When we speak of leaks in a shop, we do not necessarily infer that some of the water pipes are burst, but that through some fault in the management, a little efficiency drops out here and there, which takes away from the production, and increases the cost of the product. Stop these drops completely and you have perfect management, but as such a condition is impossible, the next best thing to do is stop as many of the leaks as possible.

A plumber, before fixing any leaks, would first find out where the leaks are. He might adopt the policy of starting at the flooded portion, and try to trace from the various streams leading to the large flood the location of the different leaks. This policy is also adaptable in the machine business, but must be tackled in a rather different manner. You might look on the flooded portion, namely, the unsatisfactory result, showing the high cost of the product, and attempt to trace back to the various sources of trouble, but unlike the plumber's case (where water leaves its mark), inefficiency does not always leave so plain a trail.

One cannot gaze at a firm which has just failed, or landed into a quagmire of inefficiency, and tell in a short time all the reasons for the sorry state of affairs. The plumber can trace his leaks quickly, but, in many cases, it re-


F.-B. Ma.Co., Ltd.
SHEET NO.
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ORDER NO.	PATT. OR FORG. NO	DRAWING NO	NAME OF PIECE	MATERIAL	DIAM.	LENGTH	NO. OF PIECES REQUIRED	IN STORE RGH.	IN STORE FIN.	WEIGHT IN ROUGH OF ONE	PLANING	LATHE	SLOTTING	MILLING	GEAR CUTTING	DRILLING	GRINDING	ASSEMBLING	MEMO

THIS ILLUSTRATES THE TYPE OF RECORD SHEET USED — NOTE THE VARIOUS COLUMNS AND THEIR USES.

quires considerable ingenuity to follow out the whys and wherefores of plant leaks.

An Example

Take for example a case the writer has in mind:

A certain firm were turning out varied lines of machine tools, and while making a reasonable profit, they felt they were not getting the money out of the concern that they should, so decided to investigate the trouble.

Operation by operation, they went through their production system, and apart from a very few changes, found that not only was their product being produced economically, but that the maximum point of production had been reached.

In spite of these points brought to light, the opinion still existed that somewhere there was a decided leak. Someone suggested that they watch the weight of their castings closely. This idea was poo-poohed as too trivial, but the originator of the suggestion stuck to his guns and pointed out that the very fact that all castings were made outside, offered a splendid opportunity for a leak in costs.

The records were looked up, and traced in each case back to the point where the various patterns had first been made. Imagine the surprise of those concerned to find out that in some cases over 185 pounds additional weight had been added to some castings. The average-sized piece on the various machines showed around 15 to 20 pounds difference. In the year's output this made an imposing figure, being away up in the thousands. Readers might be inclined to say, Why didn't they watch this item closer? But the pitfall was a mighty easy one to fall into.

Here, in brief, was the system first adopted: When a new pattern was made for any machine, the fact was duly noted on a card with the proper date, price of pattern, what used for, and so on. As a last item on the card, the weight of the first casting produced from the pattern was also recorded.

From these various figures the net weight of the complete machine was figured.

Take for example the case of a milling machine. A machine of such nature has a certain number of grey iron castings, steel castings, brass castings, etc., etc. From each pattern card ,the weight of the piece was noted, marked on a totalling list and added together.

All steel parts, cold rolled, machine steel, and so on, were kept track of on other cards, and the weight marked on the cards. These in turn were totalled. In this way the office could tell how much grey iron, brass, steel, etc., etc., was in a milling machine of a certain type. When we say they could tell the weights, we speak from a theoretical standpoint. Perhaps it would be best to say, "they thought they could tell."

No allowance was made for variation, and, strange to say, the profits were figured on a basis as follows: We supply so much material at so much a pound, which means so much cost. Our labor cost is a certain amount, therefore adding the cost of material to the labor cost, plus overhead expense, makes a certain total.

We receive for our machine so much, and taking away the total previously figured, leaves us with a total of so much. So stated before, they were making a profit even in spite of the leak, but the difference discovered in the weights added a considerable amount to their turnover.

What was the matter with the first system? Personally, we believe it was not based on practical grounds, but altogether on theoretical ideas. No allowance was made for the fact that a pattern, when new, makes a cleaner casting, each wall being of the thickness that the designer intended, or, at least, somewhere near it. As time goes on the pattern gets rapped around, and the core box, as usual, receives anything but kind treatment.

It would seem that coremakers in general have but one ambition in life, viz., to file, file, file, at a core, until it is much smaller than intended. Of course, the pattern has been well rapped, with the result that the casting produced, carries walls, perhaps ¼ in. thicker all around than intended, and up goes the weight. To those readers who may imagine these statements as exaggerated, we would suggest they get in touch with some designer of machinery and ask his opinion. Ten chances to one, he will answer in this way: "Well—I'll leave the answer to your own judgment, but when I want a wall ⅞ in. thick I usually state ¾ in., or even ⅝ in. on my patternmaker's drawings." This answer will, no doubt, convince, and you will leave him with a peculiar look in your eye.

To conclude this article, which is not intended as a guide to leaks, or how to find them, but merely a means of quoting the one case described, let us see how this firm kept track of their product after the alarming discovery.

Naturally, they were not going to be caught again in the same trap. The first step was a trip to the foundry, where a battle royal was enacted. Threats of the withdrawal of their work, with counter threats of "We should worry" took place, before common sense prompted serious consideration to the problem.

After Old Man Common Sense got a strangle hold on the proceedings, things went much better.

Where the foundry was at fault, they admitted their guilt, while no better results could be turned out with certain existing patterns, these were either fixed up or scrapped, and if scrapped, replaced by new ones. Each pattern got a thorough inspection, which gave the new-system-to-be a fair start.

Specification sheets similar to the illustration shown were printed on thin, but tought) paper. These sheets were, of course, transparent and somewhat after the style of tracing linen. The original sheets never left the drawing office, being filed as if they were actual working drawings. Each type of machine had a set of sheets, each set subdivided into the different materials used.

The first item to be marked on the sheet was the type of machine, also the particular parts to which the sheet referred.

Then came the number of the sheet, and the number of sheets complete to the set. The other items illustrated at the top portion of the sheet were added later, as we will explain.

Now came the task of filling out the lower spaces. The order number, pattern, price, or forging number; name of piece, material, diameter and length, (if the piece was not a casting), and the number required. Last came the weight of one piece in the rough.

A blueprint was now made of the sheets, and the proper order number, number of machines going through on the order, the date, and the proper department, were all marked at the top portion. Readers can readily understand that all black parts shown on the illustration came out white on the blueprint.

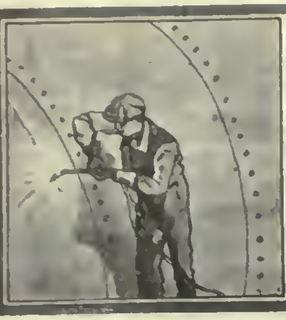
In the lower portion of sheet, the progress of each piece was carefully watched. First, the quantity in the storeroom was noted, both rough and finished material. Next, the various operations were ticked off in the order through which the pieces passed. The last space marked memo, was for any special note of interest that the clerk wished to make.

While the explaining of this system may sound intricate, it is the very reverse, and mighty easy to keep up-to-date, once it is started. As every order number is completed, a new set of blueprints are used, and the old ones either filed for future reference, or thrown away, as desired.

The progress of the work can be told at a glance. It can be immediately noticed what particular operation is holding up the work, and this condition remedied. While we have used the sheet as an example for keeping tab on a milling machine's progress, it is equally adaptable to other classes of work, and can be safely recommended to those not already familiar with its use.

Chicago inventors have patented an L-shaped private garage to hold two automobiles, either of which can use a single door that extends across the angle.

For removing water from submerged ships a motor driven pump has been invented that can be operated at depths beyond the capacity of steam pumps.



WELDING AND CUTTING

NEW HAZARDS IN ELECTRIC-ARC WELDING*

By ALFRED W. JANSEN

THE adoption of electric-arc welding in the shipbuilding industry as a substitute for riveting has presented new dangers to workmen, which, under some conditions, are unusually hazardous. Care has been taken for the eye, for in recent years the dangers from this intense light have been studied by specialists and adequate protection has been given. But the harmful effects of these light rays upon the tissues of the human body has had little attention. How to protect the workman from this hazard is more easily solved when the cause of the intensity of the light ray is known under all conditions.

The complete spectrum usually presented in the process of electric-arc welding is composed of the visible, the ultra-violet, and the infra-red rays. The ultra-violet and the infra-red, the invisible rays, are those harmful to the exposed tissues of the body. The intensity of the invisible rays is determined by the temperature of the arc and by the surroundings, which may either reflect or absorb the light. While it has been known that painful body-burns have followed exposure to these extreme light rays, it has not been determined whether they are caused by the ultra-violet or the rays in that point of the spectrum where the X-ray is found. The infra-red rays are not the cause, for while they have an irritating effect and are rather uncomfortable and fatiguing, they are not especially dangerous.

There are no great hazards in arc welding done in the open, in shops, or in places where special screens may be erected to protect the welder and those near by. They have not been serious in confined places such as boilers, where the surroundings have absorbed some of the intensity of the light and not reflected it. But on board ship, in compartments where the working space is hardly large enough for two men to be employed at the same time, and where the entire surroundings have been covered with red lead, the dangers of the light rays seem to be greatly increased.

Not long ago, electric-arc welding was used aboard a large steel ship under construction, in a compartment as described above. The welder had worked with the same apparatus for some time under ordinary conditions and had not experienced any burns on the exposed parts of his body. Within a few hours the man complained of burns on his neck and chest. A close examination of the skin showed it to be dried up and cracked, like an old piece of china, on which the glazing has become crazed. Added to this the skin was slightly inflamed and was deeper in color on the right side of the neck. Here there was a spot about the size of an egg which seemed to have been subjected to more exposure than other parts of the body. There was a little tinge of blue on the inflamed spot which looked like a burn caused by the X-ray. It was decided that this was due to the improper adjustment of the face-mask, which caused constant exposure to the direct rays. The burns on the back of the neck were apparently caused by the intensified rays reflected from the red lead.

After four days the burned condition healed sufficiently to permit further experiments to determine the cause of this unusual condition. The welder was supplied with a linen bandage lined with lead foil, which he wore as a collar to protect the entire neck. As ultra-violet rays will not pass through lead, and as no further burns appeared, it was decided that the ultra-violet rays were the cause of the trouble. As the welder had worked with the same apparatus under other surroundings, it was concluded that the reflected rays from the surfaces painted with red lead were increasing the power of the harmful rays to such a degree as to cause painful burns. Such severe burns might even lead to cancer.

The next experiment was made by welding in a compartment that had not been red-leaded, and where the surfaces were of the natural metal color. The hazard in this case was very much reduced. As no special apparatus was available for measuring the intensity of the rays in the red-leaded compartment, it is not known whether the ultra-violet rays had reached that point in the spectrum scale where the X-ray is found. It seems, however, that the red lead had either the effect of absorbing the infra-red rays, and thereby intensifying the ultra-violet, or the red lead converted the infra-red to ultra-violet rays.

As in shipbuilding these working conditions in a compartment are common, and the burns are so intense, a necessary precaution is to have all of the welding done before the surrounding surfaces are red-leaded. This is the surest way of giving the workman maximum protection.

* From Metal Trades.

PRESSURE OF ACETYLENE IN WELDING INSTALLATIONS

The question of increasing the pressure of the acetylene gas oxy-acetylene installations has formed the subject of long discussions in the German technical papers during the war. It is a question that was given considerable attention by the Union de la Soudure Autogene some months before the outbreak of war.

Acetylene installations have been proposed and even constructed—in Germany especially—in which the acetylene gas, after leaving the purifier, has been compressed by means of a small automatic compressor into the service piping at a pressure of 3 to 4 pounds per square inch. A storage tank serves as a reservoir and regulator.

On the other hand acetylene generators have been developed in the United States which generate and supply the gas up to a pressure of one atmosphere. A French company have for a long period constructed generators producing gas of a pressure of about 2½ pounds per square inhc.

It is natural to ask, in view of the tendencies to use increased pressures, at what pressures the acetylene should reach the blowpipe. A little reflection and a few experiments lead to a very clear solution of this problem.

The blowpipes which utilize dissolved acetylene, amongst the earliest to be used, always give excellent results. Very rarely is there a return of flame or detonations, whilst the consumption practically agrees with what is considered the ideal, namely equal volumes of oxygen and acetylene. Further, the two gases enter the blowpipe at almost the same pressure, which, in comparison to other blowpipes, is high for the acetylene and low for the oxygen.

Blowpipes utilizing acetylene produced direct from generators were designed after those for use with dissolved acetylene. The oxygen being used to obtain the necessary velocity, of flow, the construction was much more difficult, and for many years this type of blowpipe gave results distinctly inferior to those obtained with dissolved acetylene. To the success of dissolved acetylene may be traced the idea of utilizing the acetylene at a pressure much higher than that given by the ordinary type of generator. It was considered that this was the most important factor for the good working of blowpipes.

But the construction of low pressure

blowpipes has made great progress during the past ten or twelve years. Blowpipes have been placed on the market which aspirate the acetylene with much lower pressures of oxygen and at the same time obtain a more perfect mixing of the two gases. The return of the flame has almost been overcome, whilst the proportion of oxygen to acetylene consumed in the blowpipe has been reduced from 1-5 or 1-6 to 1-3 or 1-2, and even lower. In a way one can say that with a well designed low-pressure blowpipe the results obtained are practically equivalent to the dissolved acetylene blowpipe.

The question of the pressure of acetylene is always cropping up, but less than in previous times. In many cases it is only necessary to very slightly increase the pressure by simply loading the gas holder for example, for obtaining more satisfactory results with a particular make of blowpipe. The French Association have shown that a pressure of 8 to 10 inches of water is practically sufficient with good blowpipes using pure acetylene.

The use of dissolved acetylene has advantages of simplicity and convenience which are incontestable, but it is useless to attempt to follow its path with generator practice which give entirely different and sometimes dangerous conditions.

It is preferable, where increased pressure is required, to use, say a medium pressure generator on the lines of the French Company in which the pressure does not exceed four pounds per square inch.

To repeat, it is possible to obtain just as good results with good modern low-pressure blowpipes supplied from a well-designed low-pressure generator with acetylene at a pressure of 8 to 10 inches of water. The service piping being designed so that at a maximum consumption the loss of pressure does not exceed ⅝ inch, and where the hydraulic back pressure does not absorb more than 2 inches of pressure.

It is necessary to note that these remarks refer to the present, but it is clear that blowpipes have not reached their ultimate perfection. One can forecast, however, from the above remarks, that, on the grounds of efficiency and economy the replacement of low pressure generators by installations working at a high pressure, the day is far distant.—"Acetylene & Welding Journal."

INDUSTRIAL SAFETY CODES AND THE AMERICAN ENGINEERING STANDARDS COMMITTEE

The Bureau of Standards in Washington held a notable conference on industrial safety codes, at which there were representatives of practically all organizations of a national scope interested in any of these wide phases of industrial safety.

There was a thorough discussion of the whole situation, the consensus of opinion being that there should be a large number of industrial safety codes—perhaps 50 or even 100—developed during the next few years.

The subject is a very far-reaching one. Not only are vast financial and industrial interests involved, but it is said that the welfare of more than six million workers is directly involved in the work of a single organization, the National Safety Council.

The conference unanimously voted that the preparation of all such safety codes should be under the auspices and rules of procedure of the American Engineering Standards Committee. In accordance with the recommendation of the conference, the American Engineering Standards Committee requested the International Association of Industrial Accidents Board and Commissions, the Bureau of Standards, and the National Safety Council to organize a joint committee on safety codes, this committee to include representatives of these bodies, and such others as they may consider advisable, with the understanding:

(a) That this joint committee shall report upon safety codes required, priority of consideration of the codes, and sponsor bodies for their preparation.

(b) That the joint committee be requested to make a progress report by February 1, 1920.

In compliance with this request of the Standards Committee, the three bodies have organized certain committees to carry on the work. These included some of the best known business and safety men in the country.

It is planned to add two more members to the committee, one each from the Ohio and the California commissions.

The committee held its first meeting in Washington on January 9, at which time tentative recommendations were formulated for some thirty safety codes. This committee, which represents in its own personnel a large range of interests, is actively at work. It is consulting a large number of other interests involved. Rapid progress is being made, and it is expected that the committee will be able to render an important preliminary report in the near future.

A new French material for waterproofing leather, cloth, paper, and other materials, is described in a recent issue of the "Chemical Trades Journal." It consists of a mixture of eight parts of amyl acetate and four of castor oil, with one part of sulphur chloride stirred into it. Though this forms a jelly, giving off hydrochloric acid, it liquefies after being kept tightly covered a few days, and, the acid being then neutralized with barium carbonate, gives a colorless solution on filtering. To make a varnish, nitrocellulose is dissolved in the liquid after the addition of alcohol or benzine.

In the Paris observatory clocks are kept 90 feet under ground, where the temperature has varied less than one degree in several years.

WHAT MAKES GOOD INSPECTION*

By Lew R. Palmer

Quite properly tact has been given first place in consideration of the subject of Good Inspection. An inspector may have education, practical experience and ability, but unless he has tact he lacks the main essential of a good inspector.

Those of us who have done pioneer safety work learned at the outset that promoting safety was largely a matter of salesmanship, and a good salesman cannot be successful unless he is tactful. Safety must be sold from the top to the bottom—to the management and to the workmen.

I recall a discussion between a Pennsylvania factory inspector and a steel mill safety inspector, where the factory inspector could not understand how a certain division of a large steel plant had made such improvement in safeguarding and in accident prevention. According to the State inspector, he had never ordered a single safeguard installed but that, the man in charge of the division claimed, it would "surely shut down the mill if installed." The plant safety inspector on the other hand said it was very simple to secure the installation of guards.

The plant inspector knew his man. He knew that he was an enthusiastic baseball fan, and in most cases the interview started with a discussion of the latest achievements of the local prospective pennant winner. Eventually, some of the accidents occurring in other departments would be discussed. The good records that had been made through team work in some rival mill or department would be commented upon, and the sporting blood of the superintendent in question would soon begin to circulate. Before the safety inspector had left the mill one or more of the safeguards he had gone down to the mill to have installed had been recommended by the superintendent himself. In most instances it is far easier to get people to do things because they want to than because they have to. In the case of the plant inspector the safeguard was installed in a remarkably short time, and woe be unto the foreman or workman responsible should the guard not be maintained in place.

It can be truthfully said of Faith, Hope and Tact, the greatest of these is Tact.

The welder should learn to weld quickly, using the largest tip consistent with the job. It is much the same as using a hammer. If a machinist has small work to do he chooses a light hammer for any hammering required, but if the job is heavy, and he knows his business, he will use a heavy hammer. Less distortion will be produced in welding with as large a tip as the job will stand than would result if a small tip were employed. Less gas and less time also will be required, and the job will be sounder throughout.

*From an address before the Fourth Industrial Safety Congress of New York State.

WHAT OUR READERS THINK AND DO

THIS MAN BELIEVES THAT STRATEGY IS NOT CONFINED TO WAR ALONE

Editor, CANADIAN MACHINERY: The topic recently opened for discussion relating to the opportunities for the ambitious worker, is one which I suppose has given every live mechanic something to reflect upon. To me it seems as though most of the shops are full of "Industrial Jeremiahs" sitting as it were under their respective juniper trees and bewailing their fate with respect to their calling in the field of industry.

Assuming that we are to deal with the situation as we find it in Canada, let me proceed to give my views of the Canadian executive in general. The field is crowded with ambitious men, more so to-day than ever before. There is a continual striving for position as leaders of men in religion, politics, both municipal and general, and even in the smallest machine shop. Our friend H. H. J. in his recent article appears to be looking at the question simply from the standpoint of mechanical proficiency. If Mr. H. H. J. imagines for one brief moment that, by being the best mechanic he is qualified for the biggest position, some day he will wake up with a bunch of new ideas in his head. Usually the best worker is found "working." On the other hand, to state things plainly, so to speak, the boss's job is a good deal a matter of politics. Besides his worries in connection with his everyday duties he has constantly before him the spectre coming up from beneath of the individual who can fill his position better than himself, and above him the haunting supervision of superiors who have mentally resolved that so far up the ladder he shall go and no farther. In other words it is up to himself to hold himself up and also keep climbing. If, as the old adage has it, "there are tricks in every trade," then the business of being a boss is a whole bag of tricks, and no two of them alike. In fact the business is an art and the main art is to conceal art. Probably a little anecdote will throw some light on the subject and help our friend to see things from a standpoint other than mechanical efficiency. Seeing that the incident I am about to relate happened so long ago, and the gentleman in question always has such a multitude of schemes on hand, he will naturally be too engrossed to recognize this narrative even should he happen to read it, so here it is: "A man there was who climbed to the eminence of tool-room foreman through the power of his tongue. Albeit, somehow or other he got into such a state of affairs that his job looked to be worth about two cents judging the time he would last, considering his rate of pay. However, this one was a wise bird, and, on being called into the office one morning to receive a reprimand he resorted to the following trick, thereby showing great presence of mind. Seeing no other way out of his awkward position he very realistically broke down and wept like a child, and proceeded to inform the management that it was nervous exhaustion caused by too much application to business and he would be forced to take a rest and see a physician. Of course his doctor naturally sympathized with him and ordered up his much-desired 'rest cure,' and all our friend had to do was to go back and collect sympathy from the management. Being a married man he thought the most effective way was to bring his little daughter down to the works daily for a few minutes, and he himself tried to look anxious by wearing a very sad expression. Needless to say the management fell for this stuff fine. However, it is only a matter of time until his schemes get stale and he will be tumbled." This of course may be rather an extreme case of diplomacy, but it certainly is scheming that puts a great many executives into positions. Probably our friend, by using the foregoing hints in conjunction with his mechanical ability, will begin to climb, and if he does I would very like to hear his revised views in the columns of CANADIAN MACHINERY at some future date.

WILLIAM ERNEST.

HERE'S THE CASE AS IT APPEARS FROM THE ANGLE OF THE FOREMAN

I REMEMBER reading a statement in CANADIAN MACHINERY some time ago, of a certain foreman or superintendent, who had worked very hard during the war, on being asked what he intended to do after the war he answered that he would take a job as an ordinary machinist and work with the boys to recuperate. This is the failing of a good many foremen, as they get all the kicks and few of the halfpence. They have to take responsibility of the work turned out by every man.

Many a time the workman is confronted with a problem which taxes or perhaps overtaxes his mechanical ability, and he goes to the foreman for instruction. The foreman is expected to hand out a snap decision which is perfectly sound in every respect. If it develops later that Bill or Tom has been able to improve on the foreman's original suggestion, it does not by any means follow that Bill or Tom ought to have the foreman's position.

The ideal foreman ought to be the best mechanic in the shop and know how to handle men and boys. That means being a good character reader; also he should be a good business man. It must be borne in mind that the foreman is not running an educational institution but a business concern, of which he must make a commercial success, and his success is measured in dollars and cents profit to the firm. If his department was running at a loss he would soon be called upon to give the reason why. Knowing this to be the case, can a foreman be blamed for not moving an expert lathe hand to the bench at which, as yet, he has had no experience, and put a green hand on the lathe just for the pleasure of instructing them both? The occasions when foremen deliberately keep a good man back for fear he should prove more capable than himself are very rare. If the man has got the initiative no foreman on earth can prevent him from rising in his profession. When I take a mental review of all the foremen I know, I can count more than 95 per cent. that have risen from the ranks, and in many cases were assisted and recommended by the foremen they worked under.

Most working men consider things from a purely selfish viewpoint and do not consider the problems of the foreman at all. He is the legitimate goat for all the troubles that occur. He has to face the music in the office, and gets it in the back from the men. He gets it both coming and going. If the men can put one over on the foreman they think they have done something to boast of. (I have no doubt many foremen could write some good stories on putting one over on the boss.)

Now what is the remedy for this state of affairs? It seems to me that we should try to see things from the other man's viewpoint, that the firm should appoint a mechanical instructor, and the apprentice should be looked upon as a liability or a responsibility and not as an asset to be handed over to the foreman to make a profit on. On the other hand the apprentice should stay with the firm long enough to reimburse them for the expense he has put them to.

Most firms are willing to consider the suggestions of their employees and pay them for any idea they adopt, but usually the payment does not begin to represent the money saved to the firm because the firm certainly won't adopt the suggestion unless it is a money saver.

I guess this letter is long enough so I will conclude by suggesting that we all learn that immortal poem of Bobby Burns, "Wad some power the giftie gie us to see oorsel's as ithers see us. It wad frae mony a blunder free us, and foolish notion."

A. FOREMAN.

REMOVABLE DEFLECTOR BLADES FOR B.&S. GAS HEATER

By F. Horner

The Brown & Sharpe gas heater, with steel blades to deflect the flame into a flat shape suitable for heating pieces quickly for tempering, is often inconvenient for other purposes, such as local heating with the point of the flame, and some kinds of blowpipe soldering operations. The sketch offers a suggestion for modifying the construction so as to leave the burner available as an ordinary one for such functions. Un-rivet the blades from the burner tube itself, and re-rivet them onto a short piece of tubing sufficiently large to slide down over the burner tube. The short piece may be split through, as shown, to afford a spring clamp, so that the fitting will not slip round.

GRAPHIC DIVISION, A TIME SAVING DEVICE

JOHN S. WATTS

The method used to divide a line into a given number of equal parts, by graphic arithmetic, is undoubtedly well known to draftsmen, but the knowledge of it is not applied as much as it might be to save time in laying out work on the board.

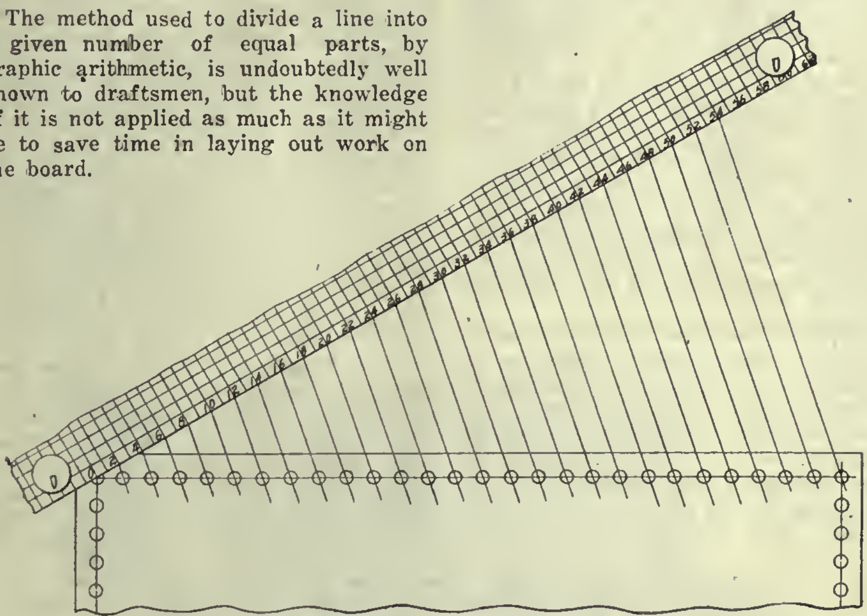


CHART SHOWING THE IDEA DESCRIBED

In the numerous cases in drafting room work, where it is necessary to divide a line into a comparatively large number of parts, such as in showing the rivets in a boiler plate, or in structural work, etc., the wrinkle shown in the sketch accompanying this article is a great time saver, and is conducive to more accurate and neater work than the time-honored way of stepping off with dividers.

The idea is simply to have a narrow strip of squared paper of sufficient length always at hand. Its usefulness is greatly enhanced by numbering the spaces, somewhat on the lines of the one shown in the sketch.

We will suppose that the plate shown is to be divided into 27 spaces, and as 27 spaces of the squared strip is rather too much smaller than the line to be divided, we will, for convenience, take 54 spaces on the strip and use only every second division.

The procedure, now, is to pin the strip on the board, as shown, i.e., with the edge of the strip (at the division line marked "o") exactly intersecting the end of the line to be divided. The other end of the strip can be pinned down on the board at any convenient place.

Now join point 54 (because we want 27 spaces, but are taking 2 spaces on the strip, and 27 × 2 = 54), to the outer end of the line to be divided, and with parallel ruler, or two triangles, draw lines parallel to the first line, and the 27 spaces will be accurately and quicky found.

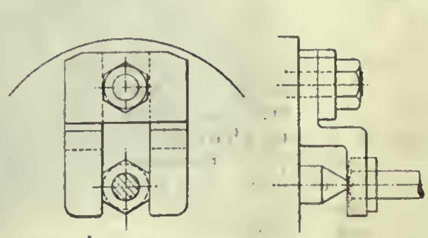
In actual work the lines would not be drawn, only marks need be made on the line to be divided. And where the line was not too long, a sheet of squared tracing paper could be used, and the points pricked through directly onto the line without having to use triangles.

"WHAT SHALL I MAKE?

By Donald A. Hampson

A good many mechanics, fired with a desire to go into business on a small basis, have asked themselves that question. One answer may be found in the crying need of the automobile repair business. "An expansion reamer in sizes from ⅝ inch up." There is not a garage in the land that wouldn't buy from one to a dozen of these tools that are more useful to them than a lathe or a press, yet dealers cannot supply them, and catalogues do not show any except in sizes much too large for automobile work.

An elephant without tusks seems almost impossible, yet in Ceylon the male elephants have no tusks at all; they have miserable little grubbers projecting two or three inches from the upper jaw and inclining downwards.

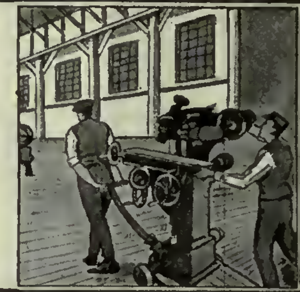


ADJUSTABLE BOLT DOG

By F. Horner.

In place of the ordinary solid bolt dog, the sketch offers an alternative in the way of a divided construction, the halves being set and clamped to suit the size of bolt head to be driven. A stout clamping-plate is laid over the tail ends of the halves, and pulled down on them; serrations may be cut on the meeting surfaces to assist in preventing skidding.

DEVELOPMENTS IN SHOP EQUIPMENT

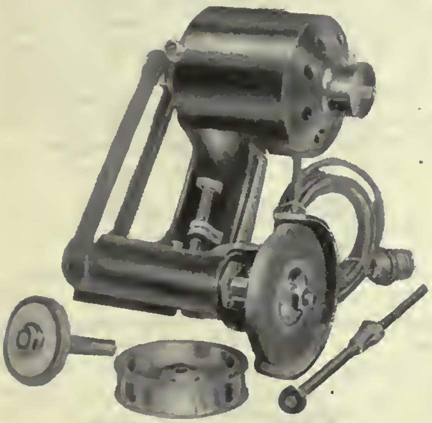


COMBINATION GRINDER

The National Machine Tool Co., Racine, Wis., have placed on the market what is known as their combination tool, cutter and gauge grinding machine.

This machine has been designed for any kind of grinding performed in the tool room or machine shop. It has a motor placed over the spindle, which makes it possible to grind cutters, arbors, reamers, mandrils, etc., between centres, on either a large or small lathe.

When using the grinder on lathe, planer, shaper, or milling machine, the motor is always out of the way, allowing the grinding wheel to be used right down to the limit.



GENERAL VIEW OF GRINDER

The grinding arbor has a hollow spindle like a lathe or screw machine, with a collet to hold 5-16 bar for internal grinder. This feature makes the internal grinder adjustable, and can be let out to suit the nature of your work.

This style machine can also be used for lapping small dies, bushings, and any kind of work usually performed in a lapping machine. It can be used in the shaper for many purposes, including the making of snap gauges, while by placing on a large wheel you can accomplish surface grinding.

As the name implies this machine is a combination grinder, and has been designed with the object of relieving the tying up of other machines. By its use, work which formerly was accomplished on lathes and other machines can be readily done on this grinder.

The main bearings operate on balls, and the wheel moves over the work, instead of moving the work over the base of the machine. The complete weight is only 50 lbs., which makes it easily portable.

LAFAYETTE GRINDER

The Lafayette Tool & Equipment Co., 21 S. 12th St., Philadelphia, Pa., has recently placed on the market a universal grinder for precision tool-room work. This machine is illustrated in Fig. 1 and Fig. 2. While one of its most obvious applications is on a tool-room lathe for both internal and external thread gauge grinding, this machine is also intended as a grinding machine when used on the bench, and as a grinding attachment to be applied to lathes, milling machines, shapers, planers, etc., to handle a variety of work. The grinding wheel spindle bearing housing has a longitudinal movement in a saddle, which in turn has a vertical movement on the column. A swivel is provided with a protractor of a large radius for inclining the grinding wheel spindle, when thread grinding, to suit the helix angle. Micrometer dials are provided for both longitudinal and vertical adjustments, making it very convenient to obtain accurate settings whenever required for precision work.

Realizing the importance of service rendered by the spindle construction in any precision grinder running at 25,000 revolutions per minute, which is required to produce work that is accurate to within 0.0001 inch, the manufacturers have developed a style of spindle which they claim to be entirely free from vibration, even under the most severe working conditions, and one which will produce an unusually smooth finish. The spindle is made of a special analysis steel, hardened and ground, and the bearings are of Non-Gran bronze, lubricated from a reservoir of oil, and protected against oil leakage, dirt and grit by felt washers. The bearings are tapered and readily adjustable for wear. The driving shaft is independent of the grinding wheel spindle, preventing transmission of pull from the driving belt and allowing the wheel perfect freedom of operation. Adjustment is provided for belt tension, and the grinding wheel has downward action, so there is no danger to the eyes of the operator. A General Electric universal motor is furnished, which can operate from any 110-volt circuit, whether direct or alternating current.

Means are provided for trueing the grinding wheel that make this machine very suitable for thread gauge grinding, as well as for general purposes. The wheel trueing device is designed to accommodate three diamonds, and graduations at the base of the trueing device permit of setting it at any angle. Adjustable stops, as well as means for locking, are provided, and the trueing device bracket is adjustable vertically in reference to the column to secure proper alignment. It will be noted that, when thread grinding, the wheel is trued in the horizontal plane of the centre line of the work and lathe spindle. It

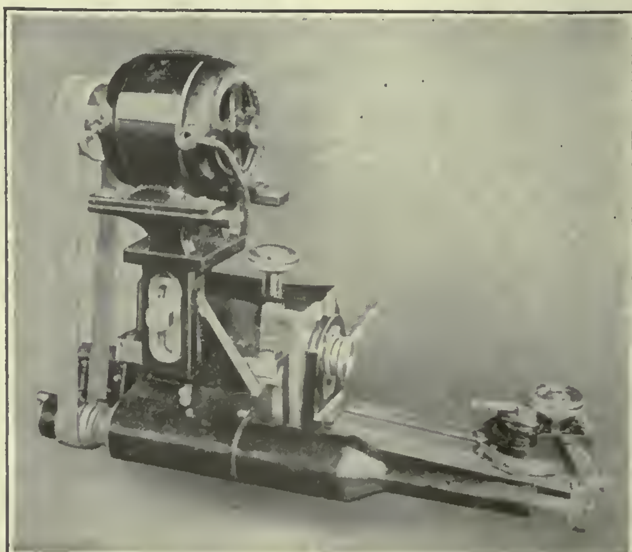


FIG. I. LAFAYETTE UNIVERSAL GRINDER EQUIPPED FOR HANDLING INTERNAL WORK.

sometimes happens, particularly when grinding internal threads, that there is no room for the trueing attachment when actually grinding. An adjustable stop is furnished which enables the trueing device bracket to be rapidly attached to the column at the proper height. The bracket is quickly clamped to the column by a stud with an interrupted thread.

For grinding deep holes and long internal threads, the manufacturers have developed an extension spindle and an extension spindle bearing housing. The application of these features to the Lafayette universal grinder is illustrated in Fig. 1. Non-Gran bronze bearings are also used in the extension spindle bearing housing. When used together with a surface plate, this machine is very suitable for surface grinding. Fig. 2 shows the adaptation of the Lafayette universal grinder to the grinding of circular forming tools. With the use of other simple adapters, securing the work to the rack, this machine can be used for a variety of bench grinding. With the use of an extra rack holding device, it is not necessary to remove the work in order to true the wheel, and the diamonds are always in the correct position for trueing.

In addition to the specific uses referred to in the foregoing, this machine, when applied to a lathe, may be used for cylindrical, taper and internal grinding. Used with the relieving attachment on the lathe, taps, cutters, etc., are relieved by grinding after hardening. This grinder may be used for grinding cutters in position on the milling machine, and when clamped to the overarm of the milling machine, it may be used for surface grinding, or clamped vertically to the overarm bracket of the milling machine; it may be used for finishing dies of various kinds. The use of pencil grinding wheels is recommended for the grinding of dies. This machine may also be attached to shapers and planers, for surface grinding and a variety of other purposes. It will be readily seen that the machine is quite universal in character, and that its many applications make it possible to adapt it to a great many uses, either in tool-room or special work or in precision manufacturing processes.

KREMER CUMMINS BELT SHIFTER

A mechanical belt shifter for machine cone pulleys, extremely simple in design and efficient in operation, is being placed on the market by the Kremer Cummins Machine Co., 1833-1835 E. 55th St., Cleveland, Ohio.

It consists chiefly of a steel channel, having teeth machined along one edge, forming a rack. This rack is supported and held stationary by two drop forge pieces, one attached to each end of the channel, as the means of connection to the hanging bracket which forms part of its support.

No part of the shifter is applied directly to the machine too or countershaft. The upper belt-shifting carriage is mounted on the channel and operated by means of a sprocket or gear in mesh with the teeth of the rack. This carriage will move in either direction as desired by means of the operating handle provided for the purpose. A suitable loop surrounds the belt and slides on two rods extremely from one side of the carriage. This provides a positive means of shifting the upper portion of the belt. A step is provided on the channel by bending out any desired tooth of the rack. This prevents the belt from being thrown entirely off the cone pulley, should the shifting carriage be moved farther than the necessary amount. A length of pipe extending downward from the upper shifting carriage carries at its extreme end the lower shifting loop and operating handle. This part is placed close to the machine pulley and provides a suitable means for shifting the lower portion of the belt.

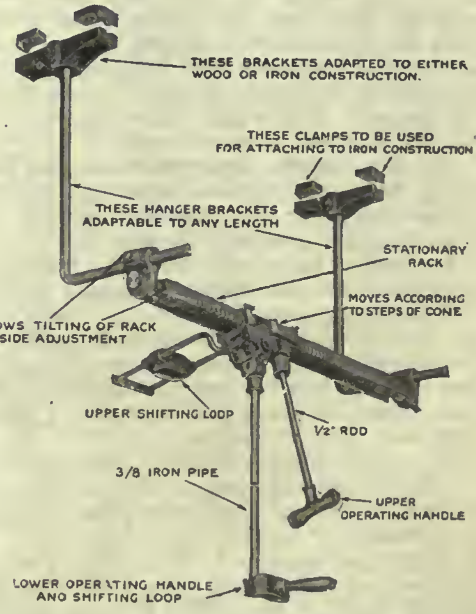
When the machine tool is equipped with safety guards, the handle of the last mentioned part may be made long enough to extend through a slot or opening made in the guard. This arrangement provides absolute protection to the operator.

In operating this device, the operator first shifts the belt to the next smallest step of the machine cone pulley by means of the operating handles. The two operating handles always assume the same position with each step of the machine cone pulley.

This belt shifter is inexpensive, easily installed, and gives a very practical method of changing the speeds of cone-driven machine tools.

Asbestos paper that has been used for protecting preheated castings and welded parts is a most excellent pack for annealing steel dies. It crumbles readily and forms a superior fireproof heat insulator, which cleans off easily and which may be used indefinitely.

FIG. 2. LAFAYETTE UNIVERSAL GRINDER IN USE GRINDING A CIRCULAR FORMED TOOL.



KREMER CUMMINS BELT SHIFTER

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PRINCIPAL CONTENTS

Well—It All Depends

IT all depends on who does the thing or who says the thing.

Some weeks ago an item appeared that Hon. Ernest Drury, Premier of Ontario, had gone to a doctor and been vaccinated.

Well, what of it? Had it happened three months ago we would have heard nothing about it. Chances are that Mr. Drury would not have been vaccinated at all. If smallpox had come into his corner of Simcoe, he would have simply steered the old grey mare into Barrie or some other place decorated with some doctors, got his little scratch and departed. Would it get on the front page of the papers? Not much. No editor would have given a line to announce such an event.

But now that Mr. Drury has come into prominence, the thing changes. Folks who argue that vaccination is right, proper and good, stow that bit away and spring it as a real argument to bolster up their case.

Mr. Drury being vaccinated and Premier Drury being vaccinated are two largely separated occurrences.

Again. An ordinary individual comes along and tells us that we are spending too much money; that we have ceased to know what thrift means. He gets a scant hearing, and the chances are that just to show how wrong and warped his views are we blow in a few extra dollars that day.

But Lloyd George makes a statement on the need of national thrift. He points out where our present policy of spend much and save nothing is going to lead us to a stone wall.

Well, what happens? Folks take a strangle hold on the neck of their money bags. They begin to look each foolish thing in the eye, and grow enough courage to say "Scat!"

But it all depends on who says things or does things. Very often their size and importance depends entirely on the size and importance of the men tied up to them.

A Boat With a History

THE Powhattan, the big American transport that was towed into Halifax a few days ago after being tossed around off the coast for almost a fortnight, has had a rather interesting history.

She was formerly the Hamburg-American liner Hamburg, and prior to that the private yacht of one William Hohenzollern, the former German Emperor.

It was on the Powhattan that former Emperor William visited England in 1906. At this time he was reputed to have paid the Hamburg-American line $4,256 a day for the use of the liner, which was then known as the Hamburg.

Later the vessel was used to carry Theodore Roosevelt and his party to Europe in March, 1909, when he made his trip to Africa hunting big game. In 1914 the liner was chartered by the American Red Cross to take doctors and nurses to the European war zone, and made a number of trips in this capacity, under the Red Cross.

When the United States entered the war in 1917 the Red Cross was renamed Powhattan and placed in the transport service. The vessel carried thousands of soldiers to Europe and return without incident, beginning her last trip on September 23, 1919.

The U. S. Steel Corporation

PEOPLE are talking and thinking in terms of millions now. It was not many years ago that a millionaire was photographed and bowed to. Folks wondered how he took that much money away from the rest of the people.

In Canada we speak glibly of the millions we have raised in our war loans. We are thinking in sums away beyond and over our heads.

The United States Steel Corporation announces an increase in wages on February 1—rather a decent thing to do just after breaking the strike directed against it. Well this increase will amount to $24,000,000 a year, a sum equal to a five per cent. levy on the entire common stock.

Chances are that holders of common stock will not be called upon to put up this levy. The over-anxious public, now willing to pay premium and super-premium prices for steel, will see that that extra $24,000,000 is provided.

Now to get back to the question of millions again—this new increase makes the annual pay roll of the U.S. Steel Corporation more than $475,000,000 per year.

For an organization that has been assassinated and dissolved and dispersed and broken up several times each way by the Sherman anti-combiners, said Steel Corporation seems to be in fairly good health yet.

The ladies of Wiseville had met to discuss a way of meeting the H. C. L. Substitutes and the intricacies of the magic art of food preparation were thrashed out. One woman told of a dish she had prepared, which she declared her husband had eaten and pronounced good, which he would not have eaten had he known that its principal ingredient was something he had always refused.

One of the ladies drew a fine point as to deception.

"Well," said the other, "I suppose you hold that a man never deceives his wife."

"Oh, no, indeed!" she said. "I shouldn't go so far as that. How would it be possible for the average man to get a wife if he didn't deceive her?"

That was bad enough, but another of the ladies felt encouraged to say that she had met that day a young woman who had been employed by her. During the talk with her which she had, she noticed that the girl's face did not shine with the usual happy expression. She inquired: "Is your husband kind to you?"

"Oh, yes, he is; he is very kind. He is more like a friend than a husband."

Metric System is Now Under Hot Discussion

THESE are troublesome times in the United States, that is as far as the system of measurements are concerned. As readers perhaps already know, there is an organization known as the "World Trade Club," which has burst forth into song in favor of the metric system. This organization has flooded the country with letters and dope of all description in an attempt to prove the metric system as the one and only system, but so far its efforts have been nil, and has awakened responsible manufacturers in general to the danger of a compulsory metric system being adopted.

Following is the report of the committee on trade and commerce of Pittsburgh, Pa. This matter was addressed to the board of directors no later than January 23, 1920:

"Your committee on trade and commerce has given careful attention to the question of the adoption of the metric system of weights and measures as suggested in the report of your committee on suggestions and recommendations, which was referred to this committee for consideration.

"At the present time there is being conducted by an organization styling itself the 'World Trade Club,' with headquarters in San Francisco, an active campaign favoring immediate legislation to make compulsory the exclusive use of the metric system, and thousands of letters have been pouring into Washington from all parts of the country, with the result that a bill has been prepared for presentation to Congress. It is not at all clear who and what the World Trade Club may be, or from what source its evidently abundant finances are procured. It is certain, however, that the country is being flooded with a mass of literature quoting innumerable authorities on the subject. In a casual glance through one of the pamphlets we find the statement: that

> 'In the British Isles, however, currency not being decimal but divided into guineas, pounds, crowns, half-crowns, florins, half florins, shillings, half shillings, pence and farthings, etc."

"In this statement the effort to create sentiment against the sub-divisions has led to inaccuracy, inasmuch as the guinea has long been obsolete, and the half florin and half shilling never existed. It is possible that on examination, more inaccuracies would be found in the great mass of literature so lavishly distributed.

The metric system was legalized in 1866 by virtue of an Act of Congress. Thus, for over fifty years it has stood on a legal parity with the English system, and fully available to all who wished to use it. It is not therefore fair to say that if it cannot win on its own merits by voluntary adoption under the protection of this law it is not entitled to win under a law of force. The present attempt is to prohibit the use of the existing system and make the metric standard the one exclusive official system.

"At this time, when, as a result of the world war, production and commerce are in a chaotic condition, and when the whole world is hungry for the products of the two greatest nations whose commerce would bear the whole burden of this inopportune tampering with the fundamentals, it would be folly to make 'confusion worse confounded' by attempting any such radical change.

"It is and always has been the practice of Pittsburgh manufacturers to quote upon inquiries as well as to execute orders based on the metric system. This is readily done by converting into our own equivalents.

"Three-fourths of the world's manufactured goods, and more than a large majority of the machine tools used in Latin America are produced on the system of measurements which we use today.

"As soon as it became known that the Chamber was to consider this subject your committee began to receive in rapid succession communications from prominent manufacturers and representative organizations, all but two of which vigorously condemned the effort to further disrupt our industrial and commercial conditions by inopportune tampering with such a vital basis of production. Among these correspondents might be mentioned The American Hardware Manufacturers' Association, The American Institute of Weights and Measures, "The Iron Age," the American Flexible Bolt Company, The American Spiral Spring & Manufacturing Company, Fawcus Machine Company, Harris Dump & Supply Company, Homestead Valve Manufacturing Company, Keystone Driller Company, Lockhart Iron & Steel Company, Locomotive Stoker Company, J. & J. B. Milholland Company, The McConway & Torley Company, Penn Bridge Company, Pittsburgh Machine Tool Company, Pittsburgh Piping & Equipment Company, H. K. Porter Company, The Simonds Manufacturing Company, Standard Underground Cable Company, James B. Sipe & Company, Union Switch & Signal Company, United Engineering & Foundry Company, Westinghouse Electric & Manufacturing Company, Westinghouse Air Brake Company, The Wilson Snyder Manufacturing Company, The Carnegie Steel Company, and the Rosedale Foundry & Machine Co.

"Only two firms appeared to favor the meter-liter-gram system, and one of these qualifies its opinion by stating: 'Unless the changing over would have an effect that we do not know of.' That effect, as indicated above, would be to practically eliminate from the world's markets the products of the two great commercial nations affected by increasing inefficiency and decreasing production through the changing of standards, gauges, dies, tools, drawings, specifications, patterns, machinery, etc., and the enormous expense incident thereto, at a time when costs are higher, production lower, and demand greater than ever before.

"BE IT THEREFORE RESOLVED, That the Chamber of Commerce of Pittsburgh unqualifiedly condemns all efforts to effect any change in the existing system of weights and measures as impractical and inimical to the trade and general commercial interests of our country, and

"BE IT FURTHER RESOLVED, That copies of this resolution be sent to the Chamber of Commerce of the United States, to our Representatives and Senators in Congress and to the chairman and members of the Committee on Coinage, Weights and Measures, to the American Chamber of Commerce in London, and to the Hon. David Lloyd George. Also to the Chamber of Commerce in San Francisco."

HARD OR SOFT TIRES

There is a good deal of doubt amongst road transport engineers, whether the solid rubber tires used on the majority of commercial vehicles should be hard or soft. Some engineers advocate hard tires—the harder the better—and others are in favor of soft tires; and there are still others who hold that the choice depends upon the condition of the roads and the design of the vehicle, especially in relation to its springs. It may seem curious that this point has not already been cleared up, but the reason is simply that with the usual mechanical drive from a petrol or steam engine there is no means of determining the exact amount of energy supplied to the wheel. Until this is known, the relative efficiencies of different hardnesses of tire cannot be more than guessed at. With electric vehicles the case is different, as the amount of current used can be measured to the minutest fraction and the efficiency of the motors and other parts of the equipment is fixed. Therefore the Electric Vehicle Committee of Great Britain recently decided to organize a series of thorough tests to bring the matter to a conclusive issue. These tests will be of great value to the motor industry in all parts of the world.

The interior of some passenger cars on the Egyptian state railways is cooled by tanks of ice, from which the air is circulated by electric fans.

MARKET DEVELOPMENTS

A Feeling of Uncertainty Pervades the Market

The Advisability of Further Advance in Prices Causes Discussion in Producing Ranks—Exchange Situation Very Unsatisfactory—Supplies Due for an Increase—Machine Tool Activity Largely Through Automotive Industry—Scrap Metal Market Uncertain

NO person would care to predict the market situation of to-morrow. The producing ranks in the iron and steel market have practically started a contest. These forces are about equally divided, one side desiring a further advance in prices, while the other side are attempting to curb this runaway tendency, claiming that in the long run it would be to the pecuniary advantage of all producers if prices are not advanced at the present time.

One concern adheres to its principle that steel prices should not be advanced above the March 21 price, while another concern claims that prices should be $7 a ton higher than those in effect a few months ago.

Machine tool enquiries are still improving. During the past week the placing of orders has kept up at a good rate. Much of this business, however, can be ascribed to the scramble of prospective buyers to take advantage of a few days' grace accorded them by certain machine tool manufacturers who have advanced prices. Since the first of the year practically every line of machine tools has gone up. On some lines two advances have taken place within the past 30 to 60 days. Much of the present activity in machine tool circles is due to the incessant demands of the automotive industries. Various concerns engaged in this line are at present in the market for equipment.

There is some talk that taps, carbon drills, cutters, and other supplies are about due for an increase. While this is not official, it comes from very reliable sources, so that it would not be surprising to see this occur in the near future.

The scrap situation could be summed up in one word: "Peculiar." No one seems to want to state exactly what is going to happen. The exchange rate has the market on red and yellows all tied up. Large shipments of copper are going from England to the States to take advantage of the exchange situation. No. 1 machinery scrap is quoted at $25, but it is well known that the metal would bring more than that. The feeling existing is: "Bring us the material and we will pay the price for it. There is practically none coming in—and those having it are holding for about $40 per ton F.O.B. consumers' mill at Ontario points.

LACK OF RAW MATERIALS THREATENS PLANTS WITH TEMPORARY SHUT-DOWNS

Special to CANADIAN MACHINERY.

MONTREAL, Que., February 11.—Despite the belief that the question of exchange has had the effect of reducing the purchase of materials coming in from the States, the business in general continues to be almost normal. There is, possibly, a decline in the less essential imports, but trading with American houses continues on a comparative heavy scale. Canadian manufacturers report that demands on their lines have shown an increase of late, and this is probably due to the prevailing rate of exchange. Nervousness has been shown in some quarters over the change that has come about in the sharp falling off of British and European trade. The action of the British Government in curtailing imports of many luxuries has reacted on Canadian firms, and this situation will likely continue as long as the financial difficulties are the controlling factor.

Coupled with the depressing nature of the exchange is the evident underproduction of many commodities caused by the disturbed conditions in many industrial circles. Reports from the States indicate that through a lack of sufficient raw materials, due to inadequate car supply, many mills and manufacturing plants are threatened with curtailment or temporary shutdowns. Further than this, shippers may be confronted with a new schedule of higher freight rates as railways everywhere intimate that increases are inevitable. When steel commodities are required to be brought in from the States, coal dealers are confining their purchases to material sufficient to cover immediate needs only. This practice will be followed as long as they are compelled to pay the exorbitant premium of current exchange. Dealers here report a very strong market but refrain from quoting a fixed price on any commodity unless it be for a direct sale. The trend, however, is upward.

Metals Stronger

There continues to be a good demand for all classes of ingot metals and finished sheets, but considerable difficulty is still experienced in obtaining materials, especially in galvanized products. Imports from the States are affected owing to the high exchange rate, and deliveries are very uncertain. Tin has advanced one cent to 71 cents per pound. Spelter shows a similar advance and is quoted at 12½ cents per pound. Antimony at 14 cents represents an advance of 2 cents per pound. Other metals are very firm.

Demand Promises Good Business

Machine tool activity has been a little upset owing to prevailing conditions but the demand is still prevalent and will probably be accelerated once the exchange rate becomes more reasonable. Of course schemes are in operation to minimize the present burden, but the influence is one that tends to hold up business. Calls on Canadian tool manufacturers, and dealers who have used equipment to sell emphasize the need for machinery, but the high cost at present is an important factor.

Leather belting and lacings show a strong tone and prices are higher. The discount on extra heavy, single and double, and likewise standard, is now 10 per cent. to the dealer and 6½ per cent. to the consumer. Cut lacings are quoted at $2.25 and $2.75 per pound, and sides at $2 and $2.40 per pound to the dealer and consumer respectively.

Dealers Quote Nominal Prices

Reports of old material dealers are to the effect that business is relatively quiet in most lines. A steady demand for cast scrap is the principal order of the day, and the difficulties of securing this class of scrap is quite pronounced. Dealers are reluctant to quote definite prices as conditions are such that fixed prices are almost out of the question. The nominal quotation on machine cast iron has been advanced $2 to $26 per ton. All scraps, both metals and steels, are firm.

EXCHANGE HURTS BUSINESS HERE

TORONTO. — Between the exchange situation and the difficulty in securing material, there is a feeling of uncertainty in the market this week that is not desirable.

The talk has been for some weeks that the exchange difficulty would right itself in short order—that it was only a temporary displacement, etc.; but the trade is getting weary waiting for that time to come. As a matter of fact, it is not any use disguising the fact that there is no small amount of nasty feeling cropping up over the way in which some of the U.S. firms are insisting on the last pound of flesh in the matter of exchange. Every place the representative of CANADIAN MACHINERY called this week the question of exchange was discussed before anything else, and many of the dealers were outspoken in regard to the situation.

"Here is the way we look at the thing," remarked the manager of one of the largest selling organizations in the Dominion. "There are some firms in the United States to which we are going to send all the business we can get our hands on. There are other concerns that, as far as we are concerned, are not going to get anything. The former class are doing their best to help their Canadian trade in this financial crisis. The only interest the latter class are taking in the matter is to gouge us for the last half per cent. they can on every sale. The firms that are looking to the future, when this matter will come to normal again, are the firms that are going to find the open door here for them. It is a very short-sighted policy, and is much opposed to the idea of building up a trade that is going to be on anything like a firm foundation in the future."

Another dealer put it this way: "We have shipments on the way now in fulfilment of orders that were placed months ago. At that time, we were able to quote a definite price—a thing we do not do now. We allowed a fair margin for the exchange rate, as there was nothing in sight then to indicate that it might go worse. Five per cent., a few months ago, was considered ample allowance. Well, these shipments that are due now will mean lost money for us, as we have quoted a definite price. The difference between the amount we had allowed for exchange and the exchange rate to-day will more than take away the profit that there was for us in the deal. We do not like to keep running after a customer after we have named a definite price, so there is a loss to be met, and we are going to meet this one ourselves."

Of course, this is not done now, as prices are quoted in every case based on the exchange at the time of delivery. As a general thing, the trade is watching this very closely; but there are numerous cases where it is impossible to pass on all the exchange to the consumer, and, in such instances, the dealer or jobber has to lose part of his profits on the business.

Apart from that—and the above has reference largely to the sale of machine tools, where the sums involved are large—there is a nice demand for machine equipment, and a number of sales have been closed that run into nice figures for those handling the orders.

Increases in Supplies

According to reports in the trade today, taps, carbon drills and cutters are due for an increase, to become effective on the 23rd of this month. Taps have been selling at 45 off, and the opinion seems to be that the new figure will be 40 off.

Carbon drills to large buyers have been at several prices, although the smaller buyer has probably not secured as close figures. It is likely that 40 and 5 will be the best for any of them now.

Cutters, for some time, have been selling at 10 off, but the chances seem to be that the 10 off will be withdrawn, making the cutters net list. Of course, it must be understood that there has been no official announcement on this, and CANADIAN MACHINERY is simply repeating stories that are current in the trade, at the same time stating, though, that they come from very reliable sources.

There is a nice list out by the Canadian National Railways this week for the Toronto shops. This list is for carbon drills, and calls for 164 dozen of various sizes.

General business is reported as being very good.

Some of the supply departments are going a little more carefully in their purchasing now than they have been in the past. They have, heretofore, ordered enough at one time to keep them going for a normal six months or a year's business. "We are buying for three month periods in our supply department," reported one house this morning. "We figure it out that we would rather run a little short now and then than to get stocked to the neck with goods that might recede in price. There are others, no doubt, who will differ with this policy—and they have very good grounds for so doing, for it is hard to see any drop in sight. The only thing is this—we are doing too much business in this country on the amount of money in circulation."

A Lean Market Here

"Absolutely no improvement." That is the way the steel trade can be sized

POINTS IN WEEK'S MARKETING NOTES

Pittsburgh advices state that the question of prices is causing considerable discussion. At present the forces are about equally divided, making the condition of the market very uncertain.

The U. S. Steel Corporation believe that the March 21 price of steel, as set by Industrial Board, should still be adhered to, the 10 per cent. increase in wages granted on February 1 making no difference to the selling price. This decision confirms our statement of last week.

Toronto experiences a double trouble. Between the exchange situation and the difficulty of securing material there is a feeling of uncertainty that is far from desirable.

The scrap iron situation is likewise uncertain, $25 being the price quoted for No. 1 machinery scrap. Some dealers, however, are holding on for about $40, which proves that there is really no definite price, the feeling being, "Bring us the material and we will pay the price for it."

There is considerable talk of an advance on taps, carbon drills, cutters, etc. While this is not official it comes from reliable sources sufficient to warrant attention.

A considerable number of machine tool orders have been placed this last week, and the possibilities are for a continuance of this condition. The automotive industry are the chief buyers, several concerns of this nature being at present in the market for new equipment.

The chief feature in all markets at present is the uncertain condition existing. No one seems to be desirous of predicting the possibilities, but are content to sit tight and await developments.

up this week; and it is the truth. At the offices of the U.S. Steel Products, the information is given out that they are booking very little, as deliveries are too uncertain. That must not be taken like many of the mills, there is always the chance of a very needy customer getting through.

Plates and sheets have been marked up again this week. One Toronto warehouse was offered plate this week by a premium mill at $4 base Pittsburg, that being the highest price asked yet; but with it went a guaranteed delivery in 60 days. Were that material brought in here by a jobber, it would have to bring a re-sale price of 7 cents.

Some sheets came in this week to local houses, the Hamilton mills being the only place in Canada where any relief can originate.

Get Them Forged

An official of one of the Canadian forging plants, speaking to CANADIAN MACHINERY about the shortage in bars, stated that some places where they were held up for round or square bars were turning to the forging plants for their immediate needs, and in this way were avoiding a shut-down. Forging plants always have experts who could advise regarding this method.

Jobbers admit that the most serious shortage in bars is in the three inch and heavier. Mills are sold out for some time to come on all sorts of bars. In fact, about nine months would be a fairly correct estimate of the time for which their mills are full. One thing that helps out is that there is a fairly warehouses, from which a fairly quick delivery can still be made.

The shortage of tubes is also getting to the stage where it is becoming acute. CANADIAN MACHINERY heard of one firm in a good manufacturing centre in Ontario where they have to close the power plant because they cannot secure the tubes to make the necessary repairs, and they do not wish to operate their plant as it stands now. The peculiar part is that the tubes required are standard three-inch sixteen-foot, and yet, as far as we can learn, none of the stocks were able to supply the demand for this mill.

The exchange situation is troublesome in the steel market; but they simply pass it on to the customer.

The Scrap Metal Market

Prices that are quoted for scrap metal can hardly be accepted as the real strength or weakness of the market, as the case may be. The word "peculiar" describes the scrap metal situation about as well as anything at the moment. No one seems to want to state just exactly what is going to happen. The exchange rate has the market on red and yellows, all tied up. For instance, were an Old Country firm to buy copper in the United States now, instead of paying 19½ cents (the market price) the firm would have to pay 25.76. This means that they are not going to buy. In fact, there are large shipments going from England to the States, to take advantage of the exchange situation.

No. 1 machinery scrap is quoted at $25; but it is well known that the metal would bring more than that. The reason that the figure is left there is that we could not find a dealer who wanted to name a definite figure as the market price. The feeling is: "Bring us the material—a good tonnage of No. 1 machinery scrap—and we will pay the price for it." There is practically none coming in now, and the dealers that have it—and there are some—are holding for about $40. Of course, that price is f. o. b. consumer's mill at Ontario points.

VARIOUS AUTOMOTIVE PLANTS IN EAST DESIRE MACHINE TOOL EQUIPMENT

Special to CANADIAN MACHINERY.

NEW YORK, February 11.—During the past week the placing of orders for machine tools has kept up at a good rate, but much of the business may be ascribed to the scramble of prospective buyers to take advantage of the few days of grace permitted them by machine-tool manufacturers who have advanced prices. Since the first of the year practically every line of machine tools has gone up, and on some lines two advances have taken place within the past thirty to sixty days. Prices are now on the highest level ever known, considerably exceeding, in many instances, the prices existing during the war period.

While business has been exceptionally good for the past sixty days or more not all in the trade are optimistic as to the future. The sensational drop in foreign exchange and the tightness of the money market are regarded by some as danger signals, and a policy of conservatism among bankers as a result of these events may hold up many industrial projects which have been planned.

Prices on all raw materials and manufactured goods are mounting so high that prices sooner or later must fall of their own weight, due to the withdrawal of buyers. In the iron, steel and machinery trade the possibility of any marked curtailment in demand or reduction in prices does not appear imminent, but as the metal industries are dependent to a large extent on other industries there is some apprehension lest the foreign exchange situation may affect other lines, notably foods and textiles, and in time destroy business confidence, which is the basis for prosperity. It appears certain that exports of American merchandise to Europe will be materially reduced. Actual wants must be provided for, but there has been a great deal of speculative purchasing, which will be eliminated. Denmark is now in complete control of the purchase and sale of exchange, and is thereby regulating imports and exports, and other European countries are likely to take some similar action.

It is singular that much of the present activity in machine-tool circles is due to the incessant demands of the automotive industries. If anything should happen to check the expansion of the automotive industries the machine-tool industry would immediately feel the slack. Among the automotive plants in the East now in the market for equipment are the International Motors Co., which is buying for its three plants at Plainfield and New Brunswick, N.J., and Allentown, Pa.; the Willys Corporation, Elizabeth, N.J., which has been an almost continuous buyer for the past two or three months; the Stevens-Duryea Co., Chicopee, Mass., and its affiliated interest, Rauch-Lang, Inc.; the Rolls-Royce Co. of America, Springfield, Mass.; the Wright Aeronautical Corporation, which will build a new plant at Newark, N.J., for the manufacture of Wright-Hispano airplane motors; the Rochester Motor Co.. Rochester, N.Y., which is building an addition to its plant, and others. The Murray Motor Car Co. is moving its plant from Pittsburgh to Newark, N.J., and is expected to buy additional equipment. Companies making gears, transmissions, etc., for automobiles have been especially active, nearly all recently added to their shop equipment. The American La France Fire Engine Co., Elmira, N.Y., is buying tools for motor truck production.

In the export field there has been buying by Fiat of Turin, Italy. The purchases of machine tools in the United States by this Italian company in the past few months total nearly a million dollars, with much more still to be bought. In all the Fiat Company will require about one thousand tools, about half of which will be purchased in the United States. A representative of a large British automobile company is in this country and is reported to be ready to buy a large amount of equipment and automobile accessories and parts.

One of the largest purchasers of small machine tools is the Columbia Graphophone Co., Bridgeport, Conn., which is placing orders for the equipping of its now plants at Toronto, Ont., and Baltimore, Md. Purchases, including woodworking machinery, will aggregate several hundred thousand dollars.

Ottawa.—So far only ten applications have been received by the Air Board for private pilot certificates. The board has announced that all former members of the Royal Air Force are entitled to private pilots' certificates providing they were physically fit when leaving the force. It is advisable for them to submit their applications as soon as possible. A number of applications for airdromes have also been received.

CONTEST EXISTS IN PRODUCING RANKS AS TO WISDOM OF ADVANCE IN PRICES

Special to CANADIAN MACHINERY.

PITTSBURGH, Feb. 11.—Everything in the iron and steel market situation is made by one thing, the fact that there is a contest between two almost equally divided forces in the producing ranks, the two classes being respectively those who do not wish prices to advance and those who wish to secure the highest prices obtainable. All producers are in business for the purpose of making money, but those who object to advancing prices feel that they can see farther ahead than the others, and maintain that in the long run it would be to the pecuniary advantage of all producers if prices were not permitted to advance at this time. The precise mental attitude of those who favor price advances is not known. It may be that they think the added profits now would more than compensate for the losses later, if prices were largely advanced now, or they may have the opinion that the market is marked to go to smash at about the same time, whether or not prices are advanced.

The United States Steel Corporation adheres to its principle that steel prices should not be advanced above the March 21 or Industrial Board schedule, the 10 per cent. wage advance instituted by the corporation as of February 1 not affecting its position a particle. One large independent has pursued up to this date the definite policy that its prices should be the "January 1" prices, i.e., the prices ruling between the post-armistice reduction and the Industrial Board reduction. Another large independent, holding the same general idea, interprets it differently and holds that prices should be $7 a ton higher than those in general effect a few months ago. This means the same thing in most products, as the Industrial Board reductions were $7 a ton on all products except grooved skelp and wire products, in which the reductions were $5 a ton. Last summer all the independents advanced wire products $5 a ton. The second independent mentioned, therefore, regards $3.85 as the proper price for nails, which were $3.50 under the war control and were not reduced at all until the Industrial Board reducduction of $5 a ton, this being taken off by the independents last summer. The first independent makes an exception of nails in its adherence to "January 1" prices.

The Steel Corporation and each of the independents mentioned has entered on books very considerable tonnages, for forward deliveries, at prices ruling at time of shipment. They wish to hold prices down, but they do not wish to throw money away if it will do no good.

The other independents occupy either of two positions. Some have not formally advanced prices, but will book no orders, simply promising their regular customers that they will take care of them as best they can, at such prices as they choose to set upon the tonnage when the time comes. Others are quoting higher and higher prices and selling outright such tonnages as buyers will take, all such business being for relatively early delivery, which now means second quarter, as there is practically no rolling space open this side of April 1st.

Thus while the market situation appears on the surface to be a very complicated one, it is readily understood when the governing forces are recognized. In ordinary times, the Steel Corporation has always been able to control the market against advances, though not always against declines. Now steel is so extremely scarce and some buyers are so ready to pay fancy prices, that it is a question whether the Steel Corporation with the assistance of the two large independents referred to above, will be able to control the market, even though their combined tonnage is well above 50 per cent. of the total. The thing will be decided by the relation between supply and requirements, the supply being insufficient now, but capable of a very considerable increase if operating conditions become normal.

Production

The limiting factor in production is transportation. While the labor supply may not be ample, it is at least moderately adequate. The common talk in the iron and steel trade is that transportation is curtailing production, but that is not correct. It is simply restricting production, which has increased, but has not increased as rapidly as if a full supply of transportation had been available.

Throughout January there was much complaint of shortage of cars in the Connellsville region, limiting the shipment and therefore the production of Connellsville coke, and of cars at coal mines, limiting shipment of coal to by-product ovens. Yet the blast furnace reports now show that 15 per cent. more pig iron was made in the United States in January than in December. The increase in steel production was at least as great, and perhaps it was greater, for some steel producers drew upon stocks of pig iron, and developments in the scrap market indicated that there was heavier consumption of scrap than had been counted upon.

Car shortage has also affected the shipment of finished steel products, and at many mills now there are large accumulations of unshipped material. In some cases the accumulations are such that if transportation conditions do not improve, production will be interfered with, as storage facilities are limited.

There is a very strong probability, however, that transportation conditions will improve, for much of the trouble has been due to winter weather, which cannot last much longer. The opinion is commonly expressed that return of the lines to their owners March 1 will bring about a greater esprit de corps and thus increase efficiency.

Ore Prices Fixed

Lake Superior ore prices for the 1920 season have been established by the making of sales at $1 a ton advance over the 1919 schedule, the 1920 prices being therefore as follows: Old Range Bessemer, $7.45; Old Range non-Bessemer, $6.70; Mesabi Bessemer, $7.20; Mesabi non-Bessemer, $6.55 per ton at Lake Erie dock, price being based upon 55 per cent. iron content, natural state, in the case of Bessemer ores, and 5½ per cent. for non-Bessemer ores. The statistics show that about 1.85 tons of ore is consumed per ton of pig iron, so that the cost of making pig iron will be increased about $1.85 per ton. There is an extra in the freight charge on ore from mine to lake dock of 30 cents a net, or about 34 cents a gross ton, imposed as a war measure, which will probably come off, and in that case the benefit will be handed on to the ore buyer. The lake carrying rate will probably be $1 this season, as against 80 cents last season, so that the ore producer gets only an 80-cent advance net. The advance is very moderate, considering all the circumstances. While the new ore prices are about 95 per cent. above their ten-year pre-war average, 1904-13, pig iron is more than 150 per cent. above its corresponding pre-war average.

The common disposition to misuse facts in order to provide price boosting arguments is well illustrated by what is now being commonly said about pig iron prices in connection with this ore advance, it being claimed that pig iron ought to advance $2 a ton for the second half of this year on account of the ore advance, whereas the fact is that pig iron had already advanced $13 to $15 a ton before the ore advance occurred. If the ore producers had appropriated the logic of the blast furnacemen they could have justified an advance of $7 or $8 a ton in ore, on the basis of the pig iron advance.

Sales of foundry iron at $40, valley, seem to have exhausted about all the offerings, but little if anything has been done above that price so far for extended delivery. Basic, however, has sold at $43, valley, a sudden jump of $3. Bessemer remains quotable at $41, valley, with several 200-ton lot sales just made at $43.

A new fly trap for household use employs an electric fan, to be connected to a light socket, to draw insects into a receptacle.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$33 00
Lake Superior, charcoal, Chicago	38 40
Standard low phos., Philadelphia	40 00-40 00
Bessemer, Pittsburgh	35 00
Basic, Valley furnace	30 00
Toronto price:—	
Silicon, 2.25% to 2.75%	47 30
No. 2 Foundry, 1.75 to 2.25%	45 95

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 4 75
Steel bars, base, Toronto	4 75
Iron bars, base, Montreal	4 75
Steel bars, base, Montreal	4 75
Reinforcing bars, base	4 75
Steel hoops	6 00
Norway iron	11 00
Tire steel	5 50
Spring steel	8 00
Band steel, No. 10 gauge and 3-16 in. base	5 25
Chequered floor plate, 3-16 in.	7 50
Chequered floor plate, ¼ in.	7 00
Staybolt iron	8 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 25
Tank plates, Pittsburgh	3 50
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 90
Small shapes under 3"	3 62

FREIGHT RATES

Pittsburgh to Following Points	Per 100 Pounds. C.L.	L.C.L.
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	185

METALS

Gross.	Montreal	Toronto
Lake copper	$25 50	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	71 00	60 00
Spelter	12 50	10 75
Lead	10 25	8 75
Antimony	14 00	10 50
Aluminum	33 00	35 00

Prices per 100 lbs.

PLATES

Plates, ¼ up	$ 5 00	$ 6 50
Plates, 3-16 in.	5 25	7 00

Price List No. 38

WROUGHT PIPES

Standard Buttweld

⅛ in.	$ 6 00	$ 8 00
¼ in.	4 68	6 81
⅜ in.	4 68	6 81
½ in.	6 21	7 78
¾ in.	7 82	9 95
1 in.	11 56	14 71
1¼ in.	15 64	19 90
1½ in.	18 70	23 76
2 in.	25 16	32 01
2½ in.	40 37	51 19
3 in.	52 79	66 94
3½ in.	67 16	84 18
4 in.	79 57	99 74

Standard Lapweld

2 in.	38 81	35 34
2½ in.	42 12	52 36
3 in.	55 08	68 47
3½ in.	69 00	86 94
4 in.	81 75	103 00
4½ in.	93	1 18
5 in.	1 08	1 37
6 in.	1 40	1 78
7 in.	1 83	2 32
8L in.	1 93	2 44
8 in.	2 22	2 81
9 in.	2 66	3 36
10L in.	2 46	3 12
10 in.	3 17	4 02

Terms 2% 30 days, approved credit.

Freight equalized on Chatham, Guelph, Hamilton, London, Montreal, Toronto, Welland.

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.
4½" and larger 50%.
4" and under, running thread, 30%.
Standard couplings, 4" and under, 40%,
4½" and larger, 20%.

OLD MATERIAL

Dealers' Average Buying Prices.

Per 100 Pounds.	Montreal	Toronto
Copper, light	$14 00	13 75
Copper, crucible	17 00	17 00
Copper, heavy	17 00	17 00
Copper wire	17 00	17 00
No. 1 machine composition	15 25	16 00
New brass cuttings	11 00	10 75
Red brass cuttings	14 00	14 75
Yellow brass turnings	8 00	9 00
Light brass	6 25	7 00
Medium brass	7 25	7 75
Scrap zinc	6 00	6 00
Heavy lead	5 00	6 00
Tea lead	3 75	3 50
Aluminum	18 00	18 00
	Per Ton	Gross
Heavy melting steel	15 00	16 00
Boiler plate	15 00	11 00
Axles (wrought iron)	25 00	20 00
Rails (scrap)	16 00	16 00
Malleable scrap	25 00	20 00
No. 1 machine cast iron	26 00	25 00
Pipe, wrought	10 00	9 00
Car wheels	22 00	20 00
Steel Axles	21 00	20 00
Mach. shop turnings	9 00	11 00
Stove plate	22 00	21 00
Cast boring	10 00	11 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜" and less	15
Carriage bolts, 7-16 and up	Net
Coach and lag screws	30
Stove bolts	50
Wrought washers	50
Elevator bolts	5
Machine bolts, 7-16 and over	10
Machine bolts, ⅜" and less	20
Blank bolts	25
Bolt ends	10
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square blank	add $1.50
Nuts, square, tapped	add 1 75
Nuts, hex., blank	add 1 75
Nuts, hex., tapped	add 2 00
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	40
Sq. and Hex. Head Cap Screws	35
Rd. and Fil. Head Cap Screws	5
Flat But. Hd. Cap Screws	10
Fin. and Semi-fin. nuts up to 1 in.	35
Fin. and Semi-fin. nuts, over 1 in., up to 1½ in.	25
Fin. and Semi-fin. nuts over 1½ in., up to 2 in.	10
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws ... list plus 20,	30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$43 00
Open-hearth billets	43 00
O.H. sheet bars	46 00
Forging billets	56 00
Wire rods	55 00

Government prices.
F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$4 95
Cut nails	5 00
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 32
British Manila rope	0 26
New Zealand hemp	0 26
Transmission rope, Manila	0 43
Cotton rope, ¼-in. and up	0 80

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net

CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Vol. XXIII., No. 8 February 19, 1920

Gauging American Standard Pipe Threads

Being a Summary of the Revised Formulation of the Briggs Standard and the Gauging System Adopted by Different Manufacturers of Pipes, Valves and Fittings

By J. H. RODGERS

STANDARDIZATION is rapidly becoming the keynote of every line of manufacture. Nowhere is this condition more apparent than in mechanical engineering, and yet the indifference shown in some directions regarding the inevitable trend of interchangeability shows a marked deficiency in progressive evolution.

There are probably very few engineering problems of to-day that do not, in some degree, require the use of piping in their ultimate solution. It is only in recent years that any concerted attempt has been made to place the threading of pipes and fittings upon the same footing as other and often less important details of mechanical equipment. There is no reasonable argument why pipe threads should not have the same fixed dimension tolerances that are considered imperative in other forms of threads. The fact that a pipe thread is out to a predetermined taper of ¾ inch to the foot has permeated the belief among many mechanics that accuracy of dimensions and thread lengths is a subject of little consequence. The fallacy of this practice is too frequently shown in faulty installations, where defective pipe joints have been the source of inconvenience or even more serious trouble.

Prior to 1882 the cutting of pipe threads was a question to be solved by individual manufacturers, and while the nominal shape and size was virtually identical, there was no recognized standard that would insure interchangeability of the parts of different makers of pipes and fittings. However, at this time, Robert Briggs, for several years superintendent of the Pascal Iron Works in Philadelphia, and later as engineering editor of the "Journal of the Franklin Institute," formulated a set of standards, which have since become universally known as the Briggs or American Pipe Thread Standard. In 1886 the manufacturers and the American Society of Mechanical Engineers adopted it in detail, and master gauges were made. Following the general acceptance of the standard, conferences were held and several additional sizes, certain details of gauging, tolerances, and special applications of the standard, also the formulae and the dimensions were tabulated more completely than was originally done by Mr. Briggs.

The purpose of this article is to give a summary of the details and gauging methods underlying the production of accurate threads of the Briggs standard. The American pipe thread standard establishes the following: Outside diameter of pipe—diameter of male thread—diameter of female thread—profile of thread—length of thread—taper of thread—engagement (by hand) of male and female threads—construction and use of gauges—tolerances—use of taper threads—and the use of straight threads.

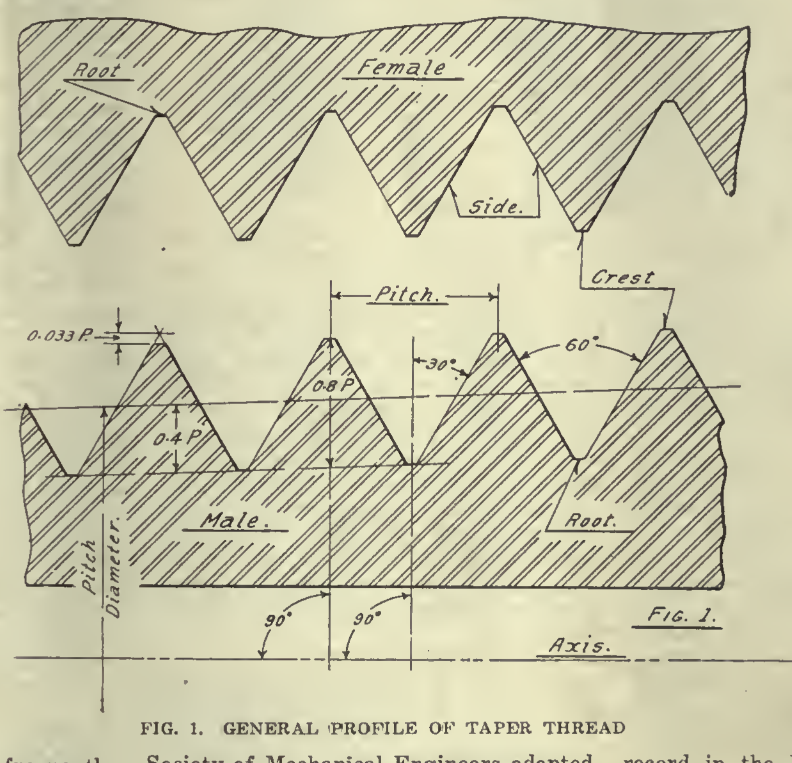


FIG. 1. GENERAL PROFILE OF TAPER THREAD

To eliminate error that might easily result from a divergence from accurate calculations, the various dimensions of this class of thread are expressed in inhces to one one-hundred thousandth (0.00001) of an inch, and in millimeters to one-thousandth (0.0001) of a millimeter. For the convenience of those readers who may not be familiar with the metric system of measurement it might be well to state that the relation between the inch and the meter used in calculating the dimensions for the Briggs thread is that established by the United States Government and kept on record in the Bureau of Standards at Washington. This equation is:—

1 meter = 39.37 inches exactly, and is applicable to all practical engineering calculations on this continent. The conversion, or the reciprocal of this equation, expressed in millimeters, would be:

$$\frac{1}{39.37} = \frac{1000}{1} = 25.40005 \text{ millimeters}$$

= 1 inch. For work of ordinary character, however, the equation of 25.4 millimeters = 1 inch, is sufficiently accurate.

In the manufacture of pipe the nominal sizes (as known to the trade) vary to some extent from the actual sizes. This is particularly true on the smaller pipes, but on 14 inch and over the sizes as listed are identical with the outside diameter of the pipe.

General Profile

In formulating the original standards, Mr. Briggs was, no doubt, guided by the recognized practice of his day, where the procedure was to measure threads by their crest (outside) and root diameters. The revised formulae, as given here, are derived from the more modern method of gauging threads from the pitch diameters, the straight sides of the thread being less liable to error than the outside diameter. These formulae and the references are shown in Fig. 16.

The profile of the thread, which is clearly shown in Fig. 1, gives an included angle between the sides of the thread of 60 degrees, the centre line of this angle being at right angle (90 deg.) with the axis of the pipe. This applies to both straight and taper threads. Present practice provides for a truncated or flat crest and root equal to 0.033 p. This gives a depth of thread of 0.8 p. Thus, for a pipe cut with 8 threads per inch, the depth of thread would be 0.8 x .125 x 0.1 or 1-10 of an inch. The flat portion, then, would be 0.033 x .125 = .004 inch.

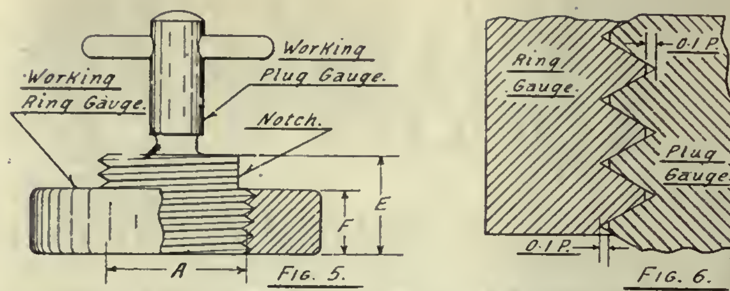
The original profile, as advocated by Mr. Briggs, provided for a slightly rounded crest and root, but the modified form now in use calls for the flat, as indicated. However, ideal conditions are only possible when cutting threads with new tools, and it will generally be found that commercial threads will appear slightly rounded under close examination. It is largely due to this condition that gauging points are now taken from the sides of the threads to minimize the errors arising from worn tools.

Length of Taper Thread

The length of the taper male thread is determined by the size of the pipe and may be calculated from the formula:—

$$E = (0.8\ G + 6.8)\ P$$

where E is the length of the taper portion of effective thread—G the outside diameter of the pipe—and P the pitch.



FIGS. 5 AND 6. WORKING GAUGES FOR CHECKING PRODUCT

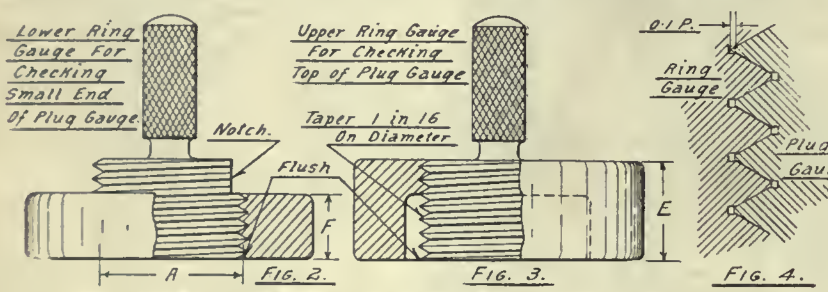
For example: Suppose it is desired to find the effective thread length on a 6 inch pipe, so that the thread would conform to the Briggs Standard. The 6 inch here mentioned is the nominal size, so that the outside diameter (G), taken from the table, would be 6.625 inches and the pitch, 0.125 inch. Therefore, from the formula, the effective length would be: $E = (0.8\ G + 6.8)\ P = (0.8 \times 6.625) + 6.8 \times .125 = 1.5125$ inches, or a little over 12 threads. It might be mentioned here that this formula gives a length that includes two threads that are a little imperfect on the crest, but which has no material effect upon the efficiency of the thread.

Gauging Methods

It was previously stated that the taper of the thread was ¾ inch per foot on the diameter, or the difference of the pitch in the axial length of 16 threads. To insure interchangeability in the similar product of different manufacturers a system of gauging has been adopted for general use, and the basic dimension upon which this gauging is determined is the normal length of engagement (F in Fig. 16) between taper threads when screwed together by hand. This dimension for the various sizes is indicated in column F of the table.

Reference Gauges

As in all effective gauging systems three sets of gauges are used, namely, master, reference and working. The first two are practically identical in every respect, only that the master gauges, comprising one plug and two checks, are primarily intended for the use of gauge and tool manufacturers, and for very accurate reference in checking gauges. The reference gauges are shown in Figs. 2 and 3, and an enlarged view of a section of the thread is shown in Fig. 4. The plug gauge is made to the dimensions given in the table, and likewise includes the gauging notch. One ring gauge, used for external work, has a thickness equal to F, is the same diameter at the small end as the end of the plug gauge, and is flush with the plug gauge at the small end and at the gauging notch when screwed on tight by hand. See Fig. 2. For checking the upper end of the plug gauge a ring that is counterbored on the small end for a distance equal to F is used. It is the same diameter at the large end as the large end of the plug gauge. As shown in the enlarged section of the thread, the roots of both plug and ring gauges are grooved to facilitate the finishing of the thread by grinding.

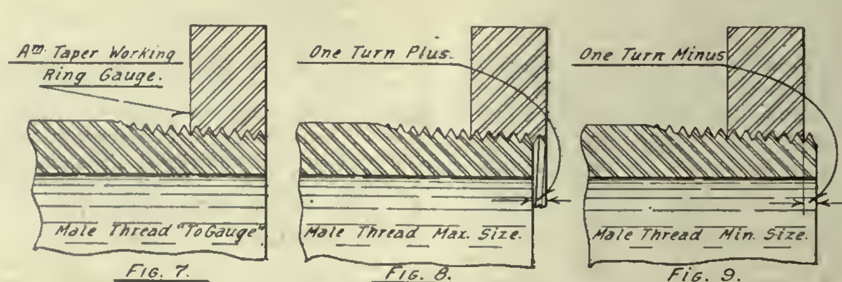


FIGS. 2, 3 AND 4. REFERENCE GAUGES FOR CHECKING WORKING GAUGES

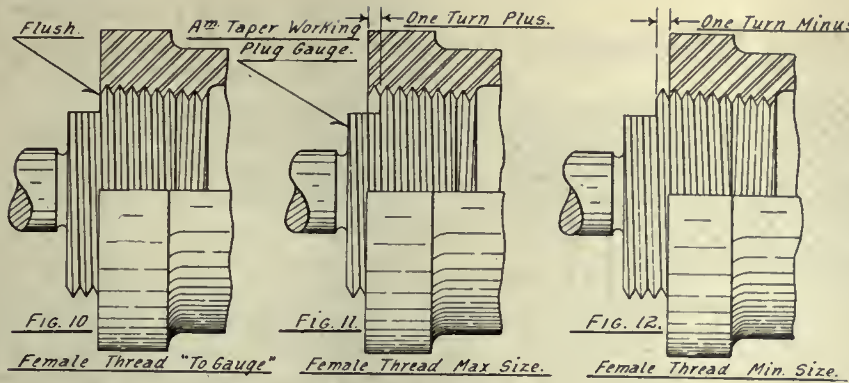
Working Gauges

One plug and one ring gauge constitute the working gauges. The plug gauge is made to the dimensions given in the table, and includes the gauging notch. The ring gauge is similar to that used for reference, only the roots are not undercut. This later detail is optional with the manufacturer. The crests are truncated to a depth of 0.1 P. The purpose of this is to avoid inaccuracy in gauging, as commercial cutting of threads is frequently done with dull tools, which may leave the crests slightly imperfect.

When gauging female threads the plug gauge should screw in tight by hand into the fitting or coupling until the notch is flush with the face. When



FIS. 7 ,8 AND 9...GAUGING MALE THREADS



FIGS. 10, 11 AND 12. GAUGING FEMALE THREADS

the thread is chamfered, the notch should be flush with the bottom of the chamfer. This method is used either for taper female threads or for straight threaded female couplings, which screw together with taper male threads. See Figs. 10 and 13. For gauging taper male threads the ring gauge should screw tight by hand on the pipe or male thread until the small end of the gauge is flush with the small end of the thread. See Fig. 7.

Gauging Tolerance

In the manufacture of any article slight variation from basic dimensions are unavoidable. This is likewise true in respect to pipe threads and the different gauges used. The wear of the gauges must also be considered. To fix the allowable variation in gauging pipe threads, certain tolerances have been established. In the making of master gauges all dimensions should necessarily be kept within the narrowest possible limit of error, and each master gauge should be accompanied with a record of all measurements and a statement of the decimal part of a turn it varies (plus or minus) from the basic dimension. In column 1 of the table is given the maximum allowable cumulation of all errors in the thread surface of the reference gauges, expressed in terms of diameter. No point in the thread surface of the gauge should be outside of the zone of tolerance. Column 1 is used when checking gauges by measurement. If the errors in the gauge are reported in terms of pitch, angle of thread, and diameter, other methods are adopted to determine the cumulation of error.

Column 2 gives the equivalent of column 1, expressed in terms of distance parallel to the axis, and represents the maximum distance which a reference ring gauge of perfect thickness or a reference plug gauge of perfect length from small end to gauging notch may vary from being flush at the gauging notch or at the small end, when referred to basic dimensions. This column is used when checking reference gauges by comparison with a master gauge. The necessary allowance must be made for the error in the master. Column 3 gives the equivalent of column 2, expressed in terms of the decimal part of a turn from the basic dimension. Use of this column is similar to that of column 2. A tolerance of .0002 inches—plus or minus—is allowed on the distance between the gauging notch and the small end of the reference plug gauge, or on the thickness of the reference ring gauge. It is possible for reference plug and ring gauges which come within all of the above tolerances to vary from being flush with each other at the small end, or at the gauging notch, when screwed together tight by hand. The maximum variation which might occur, expressed in terms of distance, is given in column 4 and gauges that come within these limits should be checked by measurement before being rejected.

Column 5 gives a maximum allowable cumulation of all errors in the thread surface of new working gauges, expressed in terms of diameter, and no point in the thread surface should be outside of the zone of tolerance. This column is used when checking gauges by measurement. Column 6 bears the same relation to column 5 that column 2 bears to column 1. Dimensions in column 6 are 16 times those in column 5, owing to the basic taper of 1 in 16, measured on the diameter. Column 6 is used when checking working gauges by comparison with a gauge, the error of which is known. The necessary allowance must be made for this error. Column 7 gives the equivalent of column 6, expressed in terms of the decimal part of a turn from basic dimensions, and is used in checking working gauges as just stated.

A tolerance of .0005 inches—plus or minus—is allowed on the distance between the gauging notch and the small end of the working plug gauge, or on the thickness of the working ring gauge. The same rules apply for working gauge tolerances as those given above for reference gauges. The maximum wear on working gauges must not be more than the equivalent of one-half turn from the basic dimensions. The maximum allowable variation in the commercial product is one turn plus or one turn minus from the gauging notch when using working gauges. See Figs. 9, 9, 11, 12. This is equivalent to a maximum allowable variation of 1½ turns from the basic dimensions, owing to the allowance of one-half turn on the working gauges.

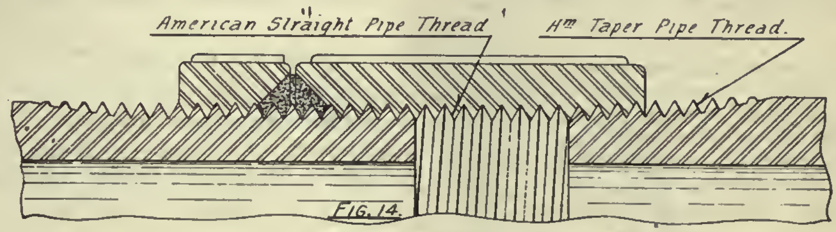


FIG. 14. STRAIGHT AND TAPER THREAD CONNECTION

Straight Thread Application

In the case of wrought iron or wrought steel couplings, the straight thread is generally used in connection with tapered pipe threads and when used for ordinary pressures make a suitable joint, as they are sufficiently ductile to adjust themselves to the taper male thread when properly screwed together. For high pressure work, only taper male and female fittings should be used. Straight male threads are recognized only for such special applications as long screws for tank nipples, etc. An application of this character is illustrated in Fig. 15.

In gauging the straight thread the working plug gauge is used, allowing for the same tolerance from the notch as for the taper thread. See Fig. 13.

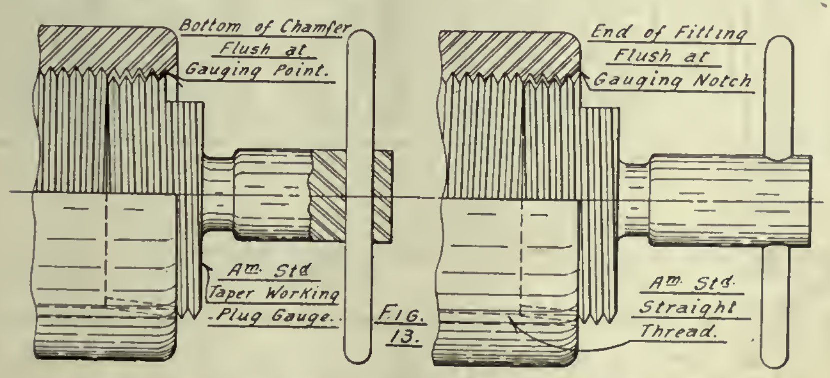


FIG. 13. GAUGING STRAIGHT THREAD OR CHAMFERED COUPLING

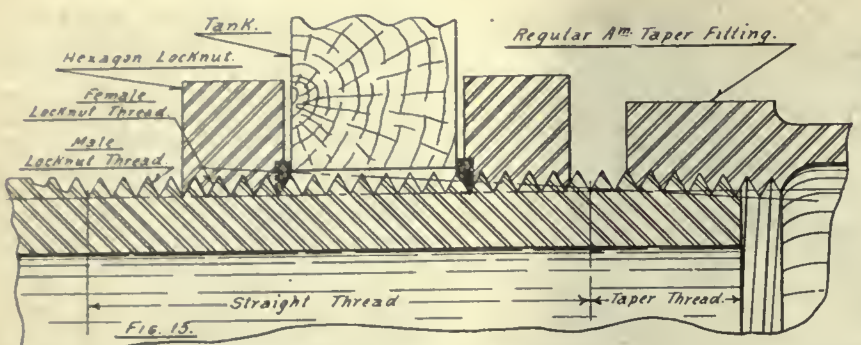


FIG. 15. TANK CONNECTION WITH STRAIGHT THREAD AND LOCKNUTS

The straight thread on the pipe enters the coupling freely by hand, the joint being made by a packing material between the locknut and the coupling. For obvious reasons this type of connection is not recommended, except in cases of necessity. An example of the locknut on a straight thread in conjunction with a standard taper thread is shown in Fig. 15. In this application an American standard taper thread is cut on the end of the pipe after having first cut the male locknut thread.

NOTE.—A companion article to this, covering a discussion on the American and the British standard systems, will appear in an early issue.

It is stated that American shipbuilding firms in the Delaware River are offering $100 per week to local machinists. According to Mr. Herbert Lewis, business agent for the machinists in Toronto, he has received a communication from the Delaware River district stating skilled shipyard mechanics can earn $100 a week. The letter asked for 400 men to be sent.

EMPLOYEES' CO-OPERATIVE GROCERY BUYING EXPERIMENT

An interesting experiment aimed to combat excessive living costs, is being conducted by the 12,600 employees of the Eastman Kodak Company in its six Rochester (N.Y.) plants. A committee consisting of one employee from each plant forms the nucleus of management for its co-operative purchase plan. Each week announcement is made on all bulletin boards of the sale for that week of one specified staple article of food at a definite price. Each employee desiring to purchase secures an order form in his department, fills in the necessary information, and forwards his individual order by the regular mailing system to a central point where a recapitulation of orders is made and the purchasing department is authorized to buy in that quantity.

Arrival of the goods for distribution is announced on the bulletin boards. Each employee calls at the co-operative store-room after working hours, pays his bill, secures his purchase and takes it home. The entire system is purely co-operative among the employees and carries its own overhead expense. Most of the labor is volunteered and a minimum of operating expense is incurred, resulting in the lowest possible price to the employee consumer. During the opening week of this plan 7,112 pounds of coffee were sold at an average saving of about 25 per cent. Flour is being sold at a saving of about 15 per cent., and canned vegetables including peas, corn, and tomatoes, at a saving of about 35 per cent. Other articles which will be sold are ham, bacon, butter, oleomargarine, and canned fish.

This co-operative purchase plan has been enthusiastically received by the employees, and will be continued as long as a material saving can be effected. Very little criticism has developed among the retail merchants of the city, and every effort is being made to keep away from a competitive condition that will materially injure their business.—"National Safety News."

N	T	A	B	E	F	G	D
Inches	Per Inch	Inches	Inches	Inches	Inches	Inches	Inches
1/8	27	.36351	.37478	.2638	.180	.405	.02963
1/4	18	.47739	.48989	.4018	.200	.540	.04444
3/8	18	.61201	.62701	.4078	.240	.675	.04444
1/2	14	.75843	.77843	.5337	.320	.840	.05714
3/4	14	.96768	.98886	.5457	.339	1.050	.05714
1	11½	1.21363	1.23863	.6828	.400	1.315	.06956
1¼	11½	1.55713	1.58328	.7068	.420	1.660	.06956
1½	11½	1.79609	1.82234	.7235	.420	1.900	.06950
2	11½	2.26902	2.29627	.7565	.436	2.375	.06956
2½	8	2.71953	2.76216	1.1375	.682	2.875	.10000
3	8	3.34063	3.38850	1.2000	.766	3.500	.10000
3½	8	3.83750	3.88881	1.2500	.821	4.000	.10000
4	8	4.33438	4.38713	1.3000	.844	4.500	.10000
4½	8	4.83125	4.88594	1.3500	.875	5.000	.10000
5	8	5.39073	5.44929	1.4063	.937	5.563	.10000
6	8	6.44609	6.50597	1.5125	.958	6.625	.10000
7	8	7.43984	7.50234	1.6125	1.000	7.625	.10000
8	8	8.43359	8.50003	1.7125	1.063	8.625	.10000
9	8	9.42734	9.49797	1.8125	1.130	9.625	.10000
10	8	10.54531	10.62094	1.9250	1.210	10.750	.10000
11	8	11.53906	11.61938	2.0250	1.285	11.750	.10000
12	8	12.53281	12.61781	2.1250	1.360	12.750	.10000
14 O.D.	8	13.77500	13.87262	2.250	1.562	14.000	.10000
15 O.D	8	14.76875	14.87419	2.350	1.687	15.000	.10000
16 O.D.	8	15.76250	15.87575	2.450	1.812	16.000	.10000
17 O.D.	8	16.75625	16.67500	2.550	1.900	17.000	.10000
18 O.D.	8	17.75000	17.87500	2.650	2.000	18.000	.10000
20 O.D.	8	19.73750	19.87031	2.850	2.125	20.000	.10000
22 O.D.	8	21.72500	21.86562	3.050	2.250	22.000	.10000
24 O.D.	8	23.71250	23.86094	3.250	2.375	24.000	.10000
26 O.D.	8	25.70000	25.85625	3.450	2.500	26.000	.10000
28 O.D.	8	27.68750	77.85156	3.650	2.625	28.000	.10000
30 O.D.	8	29.67500	29.84687	3.850	2.750	30.000	.10000

N	1	2	3	4	5	6	7	8	9
Inches	Inches	Inches	sed as dec of one tu	Inches	Inches	Inches		Inches	Inches
1/8	.00020	.0032	.086	.0068	.00040	.0064	.172	.0138	.0103
1/4	.00022	.0035	.063	.0074	.00044	.0070	.126	.0150	.0112
3/8	.00024	.0038	.068	.0080	.00048	.0077	.136	.0164	.0122
1/2	.00026	.0042	.059	.0088	.00052	.0083	.118	.0176	.0132
3/4	.00028	.0045	.063	.0094	.00056	.0090	.126	.0190	.0142
1	.00030	.0048	.055	.0100	.00060	.0096	.110	.0202	.0151
1¼	.00032	.0051	.059	.0106	.00064	.0102	.118	.0214	.0160
1½	.00034	.0054	.062	.0112	.00068	.0109	.124	.0228	.0170
2	.00036	.0058	.067	.0120	.00072	.0115	.134	.0240	.0180
2½	.00038	.0061	.050	.0126	.00076	.0122	.100	.0254	.0190
3	.00038	.0061	.050	.0126	.00076	.0122	.100	.0254	.0190
3½	.00041	.0066	.053	.0136	.00082	.0131	.105	.0272	.0204
4	.00043	.0069	.055	.0142	.00086	.0138	.110	.0286	.0214
4½	.00045	.0072	.058	.0148	.00090	.0144	.115	.0298	.0223
5	.00047	.0075	.060	.0154	.00094	.0150	.120	.0310	.0232
6	.00051	.0082	.065	.0168	.00102	.0163	.130	.0336	.0252
7	.00055	.0088	.070	.0180	.00110	.0176	.140	.0362	.0271
8	.00059	.0094	.075	.0192	.00118	.0189	.150	.0388	.0290
9	.00063	.0101	.080	.0206	.00126	.0202	.160	.0414	.0310
10	.00066	.0106	.085	.0216	.00132	.0211	.170	.0432	.0324
12	.00074	.0118	.095	.0240	.00148	.0237	.190	.0484	.0362
14	.00082	.0131	.105	.0266	.00164	.0262	.210	.0534	.0400
16	.00090	.0144	.115	.0292	.00180	.0288	.230	.0586	.0439
18	.00098	.0157	.125	.0318	.00196	.0314	.250	.0638	.0478
20	.00106	.0170	.135	.0344	.00212	.0339	.270	.0688	.0516
22	.00113	.0181	.145	.0366	.00226	.0362	.290	.0734	.0550
24	.00121	.0194	.155	.0392	.00242	.0387	.310	.0784	.0588
26	.00129	.0206	.165	.0416	.00258	.0413	.330	.0836	.0626
28	.00137	.0219	.175	.0442	.00274	.0438	.350	.0886	.0664
30	.00144	.0230	.185	.0464	.00288	.0461	.370	.0932	.0698

FIG. 16. PROFILE SECTION FOR TABLE REFERENCE

N — NOMINAL SIZE OF PIPE OR FITTING. T — NUMBER OF THREADS PER INCH. A — PITCH DIAMETER OF THREAD AT THE END OF PIPE. B — PITCH DIAMETER OF PIPE AT GAUGING NOTCH. D — DEPTH OF THREAD. E — LENGTH OF EFFECTIVE THREAD. G — OUTSIDE DIAMETER OF PIPE.

THE VALUE OF ANY OF THE TABLE DIMENSIONS CAN BE CONVERTED TO MILLIMETERS BY MULTIPLYING THE DESIRED DIMENSION BY 25, OR FOR MORE ACCURATE RESULTS, BY 25.4. THUS THE VALUE OF F, FOR A 5-INCH PIPE, WOULD BE 5 × 25.4 = 127 MM. THE NUMBER OF THREADS IN 254 MILLIMETERS CAN BE FOUND BY MULTIPLYING THE THREADS PER INCH BY 10.

Comment on Machinery Drafting Course, XI

We Believe a Further Talk on Part XI Will Not Be Amiss, as Some of Our Students Seem to Have Taken It For Granted That We Pointed Out All the Pitfalls Shown on This Plate

By J. H. MOORE, Associate Editor Canadian Machinery

IN our Feb. 5 issue we published Part XI of our drawing course. The text accompanying this plate pointed out some common pitfalls into which students might be tempted to fall. Every pitfall mentioned was referred to on the plate, that is, every error that was stated in the text was given in such a manner that each student could trace it to its proper place on the plate.

In order to see if students were following the instructions closely, we left off other important dimensions. These dimensions, while important, could be traced by steps and stages to what they should be marked. In other words, the omission of these figures in no way interfered with the completion of the plate.

Our chief reason for omitting them was to demonstrate how easily one could get into a slipshod method of dimensioning drawing. We stated in this text as follows: In concluding this portion of the course we wish to give students a little advice. Do not merely copy the plate. Study it. Figure why each piece is made the way it is. Study your projection. Watch all dimensions, and above all, **do not make the same mistakes on your plate as we have on ours.**

We have done so purposely to point out the common pitfalls, and thus keep others out of them. Evidently, some of our students did not read this paragraph closely, for we have been told that there were quite a few errors on the plate. There were, we will admit—and with good reason.

For the benefit of others in like difficulty, we will go over every error on the plate, so that they can go ahead and draw up the plate and send it in to us.

Starting at piece No. 1. There is an arrow head and line which should lead from the other countersunk hole to the dimension ⅜ drill and c'sk. Three views are shown where two are sufficient. The end view (providing this was necessary), has no dotted outline of the countersunk screw holes. Lastly, the jaws are merely marked steel, while they should be marked as to the grade steel used. Tool steel, or a high carbon steel, is usually used for such work.

Piece No. 2 has the following errors: The method of dimensioning the two 17-32 in. holes is entirely wrong. A better plan would be to write a notation 17-32 in. drill, calling attention to this dimension by means of lines, as shown at piece No. 1 for the ⅜ drill and countersunk item.

Piece No. 3 should first be marked 7 square thd's per inch L. H. The diameter of the screw should be given, and the length of the taper pin, a dimension 9-16 in. sq. in place of the one shown, and last, but most important of all, every student should be sure of their overall dimension. Total up the dimensions shown on this piece and you will see that 9 in. is incorrect. This should be 8 15-16 in. Students may say that this error should not have been made, but when they figure that they were supposed to lay this piece out to scale, they had an ideal opportunity to prove the 9 in. figure as incorrect. It will be found a very easy matter to make a blunder when totalling dimensions, so that we purposely left this error unmentioned in our text, so that readers might have an opportunity of finding it out for themselves.

At piece No. 4 there is nothing to mention except that in the end view there is no dotted outline of the screw hole.

Fig. 5 should have a dimension 9-16 in. square core in place of the one shown.

At Fig. 6 we have made numerous errors. We have omitted to mention the size of the tapped holes on the portion of the moving jaw, where the steel jaw fits. Various students told us that by scaling this they figured it was to be ⅜ tap. All this scaling, after we stated "Never take anything for granted—find might have an opportunity of finding it out for themselves.

What was to hinder figuring it out in this manner? If the steel jaw goes against this moving jaw, the tapped holes in the moving jaw will have to suit the size of screw that goes through the steel jaw. As this hole is ⅜ in. drill and countersunk, it naturally follows that the tap hole will likewise be ⅜ in. diam. Thus, by common sense deduction we arrive at a definite conclusion. Next, we omit to state the position of these holes, from the top of the moving jaw. This can easily be arrived at. Look at the steel jaw. Here we see that it is 1 7-16 in. high, while the moving jaw is only 1 5-16 in. high. This means that the steel jaw sticks up ⅛ in. above the moving jaw. As the dimension is 13-16 in. in one case, and ⅝ in. in the other, on the steel jaw, it is easily figured that the ⅝ in. dimension is toward the bottom.

From this we can either measure on the moving jaw as follows: ⅝ in. up from the bottom, or 13-16—⅛, which is 11-16 in. from the top. We also left off on this view the fact that square heads were required. We placed a 1⅜ in. dimension in place of a 1⅛ in. dimension. We also left off various arrows and dimension lines, which, no doubt, students easily discovered. We also left off on this piece one dimension, which should be 3⅛ in. centres to certain ½ in. tapped holes. Students will from this find out where we infer, that is, if they have been following instructions closely.

Having touched on these various details, no doubt students will be better prepared to go ahead with their plate, so that we can only emphasize once more the importance of sending in your work, as it is the only means we have of ascertaining how you are progressing.

The next plate on this vise will be published in our issue of Feb. 26.

REPAIR OF A BROKEN DROP HAMMER COLUMN BY THE ELECTRIC ARC PROCESS

Large industrial plants, especially those connected with metal working, are realizing more and more every day that to be equipped to handle all classes of welding jobs in the most efficient and economical manner, it is desirable to have installed both electric arc welding equipment as well as oxy-acetylene apparatus. Each process has its own particular field where it may be said to function more efficiently, and for any given case of manufacture, repair or reclamation, that process can be selected which is best adapted to the work in hand from the standpoints of quality, convenience, economy of time or cost of operation.

A recent case in point can be cited in the plant of a large manufacturer of forgings in the Chicago district. One of the columns of a 6,000-lb. steam drop hammer developed a fracture at the inside edge of the face of the column and near the top of the gib which guides the hammer in its reciprocating motion. The column was of cast steel and a large chunk of the metal had simply "jumped off" from the face of the column as expressed by the foreman. The hammer was not entirely out of commission, but was not being operated at its maximum capacity because of the possibility of inches across and the depth of the fracture was 3½ inches.

Bill Blithers Almost Becomes a Chief Engineer?

This Little Tale is the First of a Series on the Adventures of Bill in Search of a Higher Education. Although He is Not Successful in This Story, We Still Have Hopes That He Will Succeed

P. O. Box 23,
Ruebenville

To the
VERYBEST CORRESPONDENCE SCHOOL,
Educativetown, Add.
To Whom it May Concern

Deer Sir:

Having notised your ad in the paper as how you can make a common hunkie into a chief engineer, I wish to tell you I want to be one of those as soon as possible. I am sending in the envelope, the little coopon which you have in your ad, and have marked an X at the place and job I want to be in. Please tell me how much this is going to cost me and how long it will be before I can be a chief.

I am also sending you the picture that first made me think as ow I'd like to be a chief. The picture in the first part, looks just like me, and I work on sewers just as this fellow is doing. I want to be like the other part of the picture, but without the cigar, as my wife don't let me smoke.

Will I have to study hard, or will I be able to read your lessons without much trouble, and what wage will I get in a job you show in the last part of your picture, for you don't say in your ad.

Please answer quick, telling me all particulars, for I've got awful discontented since reading your ad, and seeing what I should have been. With best regards,

Yours,
BILL BLITHERS.

You know Mr. Blithers there are so many so-called schools, who claim to be ten day wonders, that one, is apt to become confused in trying to separate the bad from the good. In your case, however, I see your keen judgment has stood you in good stead, for you have written to not only one of the best, but *the* best school in the entire country. As our name implies we are the Verybest correspondence school.

You have marked your coupon absolutely correctly and although at present your employment may be of the humble order, there is no reason why before long you cannot even excel the type of gentleman we portrayed in our picture No. 2. It is a pleasure to know that these two pictures impressed you, and it was particularly noteworthy that the individual in picture No. 1, looked somewhat like yourself. This point alone proves that you are the very person who should take up our course, as our pictures were drawn from life, and from an actual example of phenomenal rise in life.

Regarding your question if our lessons are difficult. This is only a natural question, and one which we feel sure we can answer satisfactorily. Your lessons will be far from difficult, for we have simplified each lesson until it has become mere routine.

I enclose a form which you can fill out and send to me by return mail. Kindly see that you send this form properly filled out by the very next mail, as I am arranging to have your first lesson sent to you as soon as I receive the form.

Now, Mr. Blithers, regarding the price of our course, does not this seem to y u a trivial matter, when your future is at stake? We do not as a rule talk price, for one is apt to think the

BILL COULDN'T HELP BUT SEE A FAMILIAR SIGHT IN THIS PICTURE — No. I

THIS IS PICTURE NO. 2, WHICH SET THE FIRES OF AMBITION BURNING IN HIS HEART

To WILLIAM BLITHERS, ESQ.,
Ruebenville, Ill.

My dear Mr. Blithers,

To say we were pleased to receive your recent letter of the 18th is to put it mildly.

We can immediately see that you are fired by that noble spark called ambition, which, once it sets in to work (as it has in your case), means success. SUCCESS is the way we should like to write it. May the writer be allowed to get away from the we standpoint, and talk to you rather like a friend than a stranger, for after reading your splendid letter I feel more like a friend than anything else, so for the balance of my letter, it will be the I, rather than the we, that shall speak.

First I was pleased to see you had carefully read our advertisement. This is a good sign, and denotes caution on your part

amount a trifle high at first glance, but we find that by allowing the student to first fill out the form and sending along his first fee of $5.00 we have, unknown to him, started him on the road to success. However, since you have asked the question I might say that you place a $5.00 bill with the enclosed form and receive your first lesson at once. Then once a month let us ha e another $5.00 until the course has been paid. These paym nts will onl go on for a matter of 10 months, which you must admit is not l ng.

Awaiting your form, and the $5.00,
I am,

Your well-wisher,
I WANT YOUR MONEY.

P. S. Do not forget to mail the $5.00 with the form, for otherwise I could not hurry through your first lesson.

P. O. Box 23,
Ruebenville.

To the
VERYBEST CORRESPONDENCE SCHOOL,
Educativetown, Add.

Mr. Want Your Money,

I beg to inform you that I received your letter, and I am sorry but will not be abel to join your school.

Yours regretfully,
BILL BLITHERS.

Educativetown.

WILLIAM BLITHERS, ESQ.,
Ruebenville, Ill.

Dear Sir:

I cannot understand your recent letter. Do you think the prices too high? I believe that you were backward at telling me this, so I have tried hard to get you some personal and special consideration, and have at last succeeded in so doing.

Instead of $50.00 the regular price of our course we will offer you for 5 days only, a special reduction for cash, and believe me, Mr. Blithers, this is a wonderful opportunity.

Whatever you do, don't delay, but accept this splendid offer. In place of $50.00 we offer you this complete course in its entirety for not $40—not $30, but for half the real price, namely $25.00.

Act quickly before it is too late. Send in your money at once.

I am,
Sincerely yours,
I WANT YOUR MONEY

Educativetown.

WILLIAM BLITHERS, ESQ.
Ruebenville, Ill.

Dear Sir,

I am surprised at your silence, and your not accepting our generous offer.

Surely you were serious in your ambitions. If I didn't believe so I wouldn't bother writing further, but as I have good news for you I felt that I should write at once. After considerable trouble I have arranged for a space of 2 days only to let you have our course for $10.00. Imagine, $10.00 in place of $50.00. You can hardly fail to see the wonderful offer this is, so I expect to see your enrollment in the next mail.

Very truly yours,
I WANT YOUR MONEY.

P. O. Box 23,
Ruebenville.

To the
VERYBEST CORRESPONDENCE SCHOOL,
Educativetown, Add.

Dear Sir:

This isn't Bill Blithers speaking, but a better person than he—this is his wife.

Keep your course, and its special offers. My Bill started work on sewers, and knows sewers off by heart. Why—he couldn't live without the smell of a sewer, so why tempt him away from it.

Besides, I don't think your blamed school is any good no how, $50.00 to $10.00. Bah.

Can I sell eggs that cost me 50c a dozen for 25c. No, I sell them for $1.00, so I guess according to these figures your course is worth about 25c. Even at that figure I wouldn't let Bill start it. He should by rights be a toolmaker or something like that, although in a way I still think he should still stick to sewers.

Believing this letter will be the last one,

I am,
BILL'S WIFE.

Editor's Note—It was the last one on the above subject so she got her wish, to a certain extent, but Bill is not done for yet, by any means, and will be heard from at a later date in an entirely new role.

Grinding Wheels and their Various Duties*

By JOSEPH HORNER

MACHINISTS have travelled far since the early precision grinding machines were designed. At that time, and for a long subsequent period, there was only one material used for grinding wheels—the natural emery, and the term "emery wheel" exactly denoted its composition. Variations could be made in grain, and in grade, but no difference in the hardness of the grains. Further, the natural product was always impure, being contaminated with earthy matters that do not cut—oxide of iron and other substances. Naxos emery contains only about 63 per cent. of crystalline alumina. Corundum is a natural abrasive of which emery is a less pure variety. It occurs in two other forms of which the commercial kind is translucent. It is, next to the diamond, the hardest known mineral. It is also contaminated, but not to the same extent as emery. These are the only two substances which were used for grinding wheels before the possibilities of the electric furnace became realized. Since that era, the natural products have almost ceased to be employed for any work of high precision, having been displaced by the numerous artificial products of some form of furnace in which the work is either of a purifying, or of a synthetic —a building-up character. The story is almost like one of the romances of manufacture, since some very unpromising substances, coke and sand, are transmuted at temperatures far above that of molten steel, into abrasives only second to the diamond in hardness. These products are denoted by various trade names which alone reveal nothing. The result is that grinding wheels are now standardized, not alone in grain and grade, but also in regard to their cutting properties, which was never the case with the old emery wheels. The characteristics of a wheel are repeated precisely in all others of the same name and description. The value of this certainty in highly repetitive grinding practice need not be emphasized. No single firm now has a monopoly of grinding wheel manufacture. There are many in the market, some of whom have specialties of value prepared under their own methods.

What is Corundum?

Corundum—the purer emery—is a product of the electric furnace, but not in the same sense that the artificial abrasives are. The aluminum oxide is simply crystallized by the intense heat instead of naturally, and the product is not contaminated by foreign matters as the natural corundum is. The trade name of this is "oxaluma." With this exception all the products of the electric furnaces are prepared artificially by synthesis.

The first of these was carborundum, prepared at Niagara by power obtained from the falls. Coke and sand are the ingredients used. The first supplies the carbon, the second silicon, so that the product is a carbide of silicon. The diamond alone exceeds it in hardness. Sawdust is added in the furnace, but only to render the mixture porous enough to permit of the escape of the gases. A resistance core of carbon rods is inserted in the furnace, connected with the power cables, and a temperature of about 7,000 deg. Fahr. is maintained for something like thirty-six hours, after which the crystals produced are removed. Crushing, washing, and sorting the grains into the different sizes required follows.

Another carbide of silicon is that termed "Crystolin," prepared from coke, sand, sawdust, and salt. The method of production is different from the other. A core of small coke is raised to a tem-

* From Hardware Trade Journal

perature of 3,500 deg. to 4,500 deg. Fahr. by a current of 12,000 volts, which produces a chemical reaction without fusion. This material also is only second to the diamond in hardness.

Alundum is an artificial abrasive of a different class, being an oxide of alumina, resembling therefore in that respect the natural emery. It is prepared from the soft mineral earth, bauxite, which is the purest form of alumium oxide found in nature. It is first calcined at a red heat to drive off moisture, and is then fused between electrodes until a mass of alundum of several tons weight is produced. This is broken up, pulverized, and sorted for grain.

Aloxite is also prepared from bauxite, and is hard and sharp, and suitable for grinding materials of high tensile strength. The bauxite is calcined to remove moisture, is then mixed with coke and placed in the electric furnace. The proportion of coke is adjusted to remove the oxides of silicon and of iron present, but to leave the alumina unreduced. The charge is fused between vertical carbon electrodes at about 4,000 deg. Fah. A mass of several tons weight is produced, which is broken, crushed, and graded for size.

These are the best known of the artificial abrasives, but there are others, and the number grows. The aspect which interests us is that materials are now exactly correlated to the work that they have to perform, which is not the case when emery alone is available. The point is that wheels are prepared suitably for the materials on which they have to operate. Materials of high tensile strength, as the steels, require wheels of a different character from the softer brasses, the bronzes, and the cast iron. That is the first fact. The second is that apart from the materials used, the size of the grains, and the character of the bond or matrix which unites them has to be selected to suit the harder or softer nature of the materials operated on. Broadly, hard materials require wheels from which the grains are torn away quickly, more than the softer materials do. But only broadly, since the question of clogging arises in some soft materials, as brass, for which soft wheels are required. In general, materials of high tensile strength—the steels—require abrasive wheels of an alumina oxide abrasive, those of low tensile strength—cast iron, the brasses and bronzes—wheels made of carbide of silicon.

An Important Point

The point to bear in mind always is that a grinding wheel is in effect an assemblage of millions of cutting points which, as they become dulled, must be torn away from the matrix, exposing fresh sharp grains for the work. The sparks thrown off from work that is being truly cut, and not rubbed, show under the microscope as veritable chips. not easily, unless care be taken to select a proper wheel, and to run it and the work at a speed suitable.

It has been stated that a wheel 24 inches in diameter, with 4-inch face, presents approximately 1,086,171,000 cutting points per minute to the work. The laws which govern the action of these multiple tools are as precise and inexorable as those which concern the more obvious cutting tools in the lathes, planers, milling machines. The great difference is that the first are thrown out and discarded after brief service, the second are resharpened.

This is the explanation of the bonds used, denoted by the term "grade"—that is, the materials employed to hold the grains securely just as long as they retain their cutting efficiency — their keenness of points—but not a moment longer. It is a nice problem, not easy of solution apart from experience, but information on which manufacturers are ready to supply. From this aspect wheels are hard, soft, or medium. A hard wheel does not signify anything concerning the character of the abrasive itself, but denotes the tenacity, the holding power, of the bond. The soft wheel may contain the same abrasive, but the bond does not hold so tightly, but permits the grains to become torn out more quickly than the hard wheel does.

This is entirely distinct from the question of the size of grains, which vary in degrees of coarseness, determined by the passing of the grains through sieves of various meshes, ranging generally from 24 to 60 per lineal inch. In the majority of instances the grains in a wheel are uniform in size. But combination wheels contain grains of different sizes, the object sought being to avoid changing wheels for roughing and finishing, the combination of grains of different sizes in one wheel permitting of employing the same wheel for roughing and finishing.

The Classes of Bonds Used

Different classes of bonds are used for groups of wheels employed for different classes of operations. There are the vitrified, that most widely used, the silicate, and the elastic, and vulcanite wheels for special work only, for which the wheels must be very thin.

The process in widest use is the vitrified, in which the wheels are burned in order to partly melt the bond that holds the grains. These wheels are porous and free cutting, and the bond is nearly as hard as the abrasive. But large wheels made thus are liable to crack, and the control of the burning process is difficult. They are of a reddish color, and ring when they are tapped. The bond used is a clay—generally a pure grade of kaolin. It is mixed with the abrasive to the consistency of thick paint, and poured into moulds. When very hard wheels are required, they are made in moulds under hydraulic pressure. Moulds are larger than finished wheels to allow for shrinkage in drying. They are burned in a kiln when packed in fireclay saggers, the kiln being luted during the burning, which is continued during from three to five days, followed by slow cooling for a week. Silicate of soda is the bond used in the silicate process. The mixture, with the abrasive, is tamped in moulds by hand, and baked in ovens at a temperature very much lower than that required for the vitrified process. These wheels are excellent for wet grinding, but are not so free cutting as the harder grades of vitrified wheels of the same grades are. They are of a light gray color.

The very thin wheels are bonded with shellac—elastic wheels, or with vulcanized rubber—vulcanite wheels, both being baked at a low temperature. They are very hard and tough, but do not permit of so fast grinding as the others do. They are used for saw gumming, for sharpening milling cutters and severing stock. They will run in water, but oil or caustic soda damage them. They are porous.

The grain of wheels—the degree of fineness or coarseness of the grains to linear inch—is indicated by numbers. The grades—the degree of hardness or softness of the bond—are indicated by letters. The lists of different manufacturers differ here, so that those of one maker do not afford exact comparison with those of another.

Since there are so many differences in materials, not only taking note of that which divides materials of high tensile strength from those which are of low strength, but also in alloys and mixtures of the same designation, the necessity for a wide selection of wheels is apparent. The steels include scores of combinations of a few elements in varied proportions. The brasses, the bronzes, the aluminium alloys, each include many differences.

And when the wheels most suitable for any single group or specimen are selected the ultimate end is not achieved. The relations of the wheels and the work, the speeds and the question of lubrication, entail variations in the wheels selected.

Contact Between Wheel and Work

The principal problem here is that concerned with the area of contact between the wheel and the work. Obviously there is little in common between grinding cylindrical pieces of small diameter with the edge of a wheel and grinding plane surfaces with the face of a large disc wheel. In the first case the arc of contact is little more than a mere line, in the second the area of contact will often amount to several superficial inches. In the first the grains will fall away directly they are released from their bond. In the second they will remain entangled between the wheel and the face of the work. The result is that the work will become heated up and will warp. In general, therefore, the larger the area in contact, the softer should be the grade of the wheel, and the larger the volume of lubrication to drive out the grains released. Strictly the term lubricant is not correct. The liquid is used solely for cooling, and for washing away the swarf. Enormous volumes are used in present-day practice in order to prevent risk of distortion of the work.

It follows that with small and moderate increases in the areas of contact, wheels of softer grades must be used. Since a cylindrical piece of work of large diameter offers a large arc of contact to the wheel than one of small diameter does, a wheel a grade of two softer is desirable. So, in grinding bored holes, the arc of contact is much larger than when doing outside work, and again a softer wheel is wanted, and generally a larger volume of cooling liquid. Again, surface grinding with the edge of a wheel presents a larger area than cylindrical work does. And so we come to the most severe work of all, that of plane surfaces with the face of a disc wheel. And the wider the work the softer should be the wheel.

The man who aspires to operate precision grinders has much to learn, and he is always learning and gathering rich stores of experience.

Three Clamp Devices of Uncommon Design

By F. SCRIBER

TO hold a forked lever while drilling holes from both sides without springing the same is often something of a problem, and it is thought that the devices illustrated with this article will be of more than ordinary interest to anyone who has ever been up against this proposition.

The drawings show sections of jigs with reference to the forked end method of locating without regard to the shape of the other end of the work and referring to Fig. 1 this shows an arrangement by means of which the lever is located and the thrust of drilling from both directions is taken. To accomplish this the plate A made part of the stud B has two eccentric radius cut on it at R, thus, as the portion B is a snug running fit in the body of the jig C, turning this in the direction of the arrow, causes the inner bosses of the forked lever to be gripped equal distance from the centre and with the other end suitably located in both directions this device, in addition to locating the forked end of the work, takes the thrust of drilling, which is done from both sides of the jig, using bushings D and E for guiding the drills. The nut F, with washer, is used to clamp this eccentric arrangement when tight between the fork, while pin G acts as a handle to turn the same.

Fig. 2 shows a device somewhat similar to the foregoing, except that it is used only to take the thrust of drilling from both sides through the bushings A and B, other means at the opposite end doing all of the locating, and for this purpose the eccentric plate C has an elongated slot cut lengthwise of it, the method of operation being as follows:

The plate C is turned until it grips the fork, the plate being free to slide, it is then clamped by bolt D, using nut and washer E, while the pin F, working in an elongated slot, prevents the bolt from turning while nut is tightened.

A plug method of locating and clamping is shown by Fig. 3, the function at this time being to locate from a finished hole and clamp with the same motion of a stud. Referring to the drawing, the work rests on the pin A in the body of the fixture. The stud B has the end turned down to fit the hole of the work, while a plate C and pin D for turning the stud completes this arrangement.

The stud B is put in place in the manner shown, the flat X being made to slip by the plate C; this plate is bevelled on the side to conform to the cam surface on the plug and by turning the plug under the plate in the manner shown the work is clamped and located at the same time.

These clamping methods are quick acting, sure in operation and very efficient for the purpose illustrated.

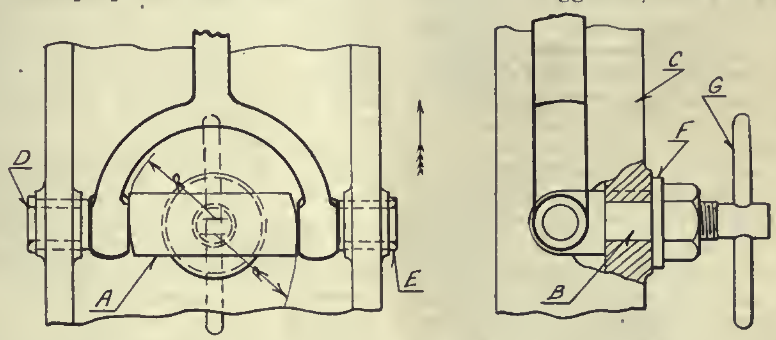


FIG. 1

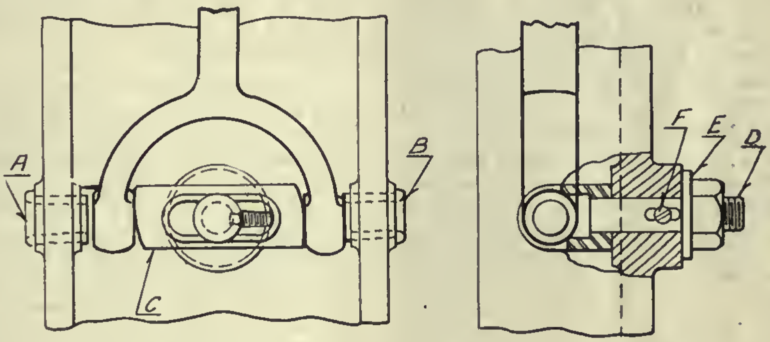


FIG 2

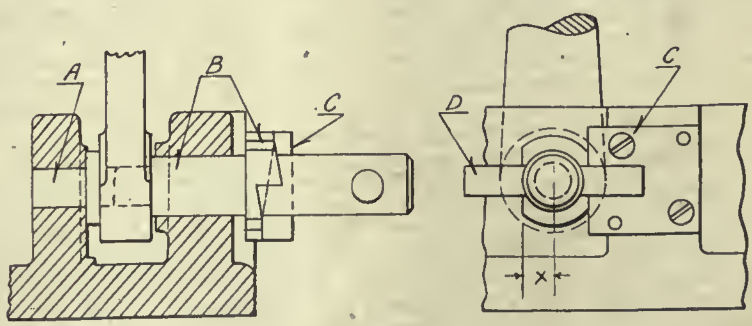


FIG..3

The reason for limiting the voltage for which alternators are built is that after about 20,000 volts, the weight of the generator increases rapidly and the cost soon becomes greater than the combined cost of an equivalent lower voltage generator and transformer. Furthermore, in the absence of a transformer the generator windings are exposed to the direct action of surges originating in the line.

The extending use of arc welding makes it desirable that the constituents of a weld should be better controlled. Refractory tubes and asbestos coatings have been suggested, but the author of an article in the "Electric Journal" is of opinion that better possibilities are offered by the development of an electrode which generates during operation, an atmosphere of inert, permanent gases enveloping the arc.

WHAT OUR READERS THINK AND DO

STILL ANOTHER ANSWER TO H. H. J.

By D. A. H.

THERE are two sides to every problem, even to H. H. J.'s, and those who had commented on his viewpoint have most certainly not taken the trouble to inform themselves of the other side, or whether one existed. Without having had experience with the great industries, whose earnings are large through systematic production, and who are in a position to enlist the necessary capital to make that kind of production possible, the writer will touch upon the other side of the problem from the standpoint of the smaller employer and his executives—plants that employ anywhere from five to two hundred men.

Let it be said first that a majority of men—workmen and employers alike—are fair and reasonable when problems are taken up separately. I say separately because that is the only fair way to treat problems of this nature; the union idea is all right up to a certain point but when it compels an employer to pay as much for a poor man's work as for a smart man's, this is where the unfairness begins, and every intelligent man in every union will concede this.

"Little George," as we called him, was a bright lad and quick, but he was careless, and so, naturally, he spoiled many a job just when that job was needed worst. He wanted to be moved to the big universal miller, and the foreman had promised that he would do so if he, George, would apply himself more diligently to his work. The man on the universal left and the foreman put Jim on the job simply because the work from that miller was pivot work for the room, and Jim, though comparatively young, was of the faithful plodder class. Little George had no real kick and he knew it, but instead of taking it up directly he agitated the matter at noon hours, working up sympathy, and a delegation headed by a rather mouthy fellow, also of the careless kind, took the matter over the foreman's head to the boss. The latter, knowing how matters stood, fired the mouthy one, and the rest of the boys, feeling very sheepish, slipped back to their machines muttering something about "George can do his own dirty work another time."

As has been said, most men are fair, even employers. The writer went to work one time for "Old Man Fellows," who, during his years of experience, has had hundreds of employees working for him. Many and many a time I have heard him called "the meanest man in Gorhem," and it was with a little feeling of uneasiness that I went to work. But our relations were always of the pleasantest, probably because I had made up my mind to do things his way to the best of my ability, and he never exhibited anything meaner than a sharpness of speech when an especially poor meal affected his stomach.

When I went to work at the trade, apprentices were paid \$3 a week for the first year. That was in 1899. Machinists received \$2 a day (I really think wages have kept pace with prices since then). Most shops were dark and dirty, all worked from 7 until 6. One of the recruits came from the country; he paid his \$3 for his board and did his washing himself Sundays; when he got a dollar more a week he took a correspondence course, and to-day he is a successful, prosperous engineer.

At that time apprentices in the railroad shop were put upon the bolt cutter job for a whole year, and in other shops they swept floors and did odd jobs. The second year was lathe work, and the third planer and vise. Sometimes a bright boy would get a chance to do drafting or to help one of the machinists on an engine job. Men trained in such a school do not have an excess of patience with present-day workmen, who are so touchy you cannot correct them or they leave, who work amid pleasant surroundings, get big money for short hours, and have so many things done for them in the way of better conditions and chances for learning and advancement. Apparently the modern man lacks stamina.

But put the same man in an employer's position or that of an executive and note the change. If he has been a draftsman and had a few hours each week when he merely had to "be there" and could roam the shop and office at will, you will find him checking each man with a stop-watch. If he has been a machinist and has started a little business of his own, he buys his tools from a Jewish vendor, even though he used to complain loudly about the "junk heaps they call machines" that he ran in his ex-employer's shop.

All similar businesses are in the same position regarding high prices that the individual is. There is a limit to what a concern can pay its men. Shops are forced at times to cut prices to get certain business because the customer may be one that cannot be lost by holding out. Competition is just as keen to-day as it ever was in numerous lines. In order to get a customer's work a firm must often take jobs that prove unprofitable as well as those that do pay.

It is for these reasons that men have to be kept on certain jobs longer than they themselves think is just. Often they hold themselves back; Jimmy wanted to get on the planers, and his superior told him he would give him "a show" as often as the opportunity came, which he thought should be two days a week if the lathe work came out all right, but Jimmy didn't like this and so he sulked and rubbered, and his net result was four days' work in six days, and he didn't get any chance at all, besides forming a habit that is always hard to break.

Then there is the case of Bob Wilbur, who was assistant to the foreman, and whose case was typical. He developed a lazy streak, took to dropping to a seat on the slightest pretext, and engaging one of the others in a conversation—result, two men's time lost. Like many others, when the shoe pinched he resented being corrected and would tell on the street of how a man was hounded at Coleman's shop, and being an intelligent, attractive fellow, his listeners believed it all. But when the plumber came to fix the pipe in the cellar, and Bob's wife sat on the step exchanging bits of gossip, which she afterwards served with the evening meal, did Bob take kindly to that sort of conversation? No, he hiked to the plumber's establishment and gave the owner a dressing down for charging him 90 cents for an hour spent in conversation.

And I recall Charlie and Ben who worked for me at the same time. Both wanted more money as their labors turned out less work, and both were strong around town on that line of talk about the low wages the shop paid. Charlie always quarrelled at home; he married to escape that and lived a cat-and-dog life with his wife; his domestic troubles were ever with him, his lips would pantomime evening blessings for his wife, and his arms would raise in threat—all this while his lathe was merrily running with a cut a thirty-second deep. We really felt sorry for him and retained him, though we didn't get more than actual wages out of his labors.

And Ben, he was building a house, working so hard wheeling dirt night and morning that he could hardly stand up during the day; naturally his production dropped way down, and the influence of a lagging man did not spur the men near him.

We hear a great deal about a plant not paying its own trained men as much after they have served an apprenticeship as they pay to open market labor. There is one good reason. It costs a substantial sum to teach a trade, and certainly every one is entitled to a return on an investment. The General Electric Co. has as modern a system of cost finding as could be devised, and they place the cost of training a machinist at $1,200. The Philadelphia Street Railway system is the best managed in the U. S., and they have computed the expense of breaking in a motorman as $250! Included in training costs are such items as spoiled work, instruction expenses, accidents, abnormal wear and tear on machinery, insurance, delayed work, loss of earnings from machinery used in instruction.

A young man dropped in the office one day and asked for a job as apprentice. He was working in the shop of a large corporation in another part of the city, and while he waited we called up that shop and asked about him; they said he had worked four years as a drill press hand and that they liked him, but they would not consider it an unfriendly act if we took him. We needed help and put him to work; frank, intelligent, good-natured, he had all the qualities that go to make one popular, and he seemed able to do plenty of good work of whatever kind was put on. But after a while we found that he was too good-natured, too ready to "Hello Bill" every workman that passed, too anxious to watch the cut on a neighboring machine to the detriment of his own. We found that after four years on a drill press he could not drill and hole to a layout (or rather would not force himself to do it), and we comprehended why the other shop had never advanced him. Eventually he was discharged, and most of the boys in our shop were sure an injustice had been done.

Turn an employee—even the most turbulent one—into an employer, and he immediately sees the other side of these questions for the first time. Employers are partly to blame for this condition for they rarely think it worth while to explain or to present any of the business end to workers.

One of our men had an opportunity to buy a one-man repair shop that had been offered as a good investment. He came to me for an opinion, said there was steady work at 75 cents an hour the year around, and he was only getting 38 cents where he was, making the proposition look very good, besides enabling him to be his own boss. He knew his trade well and I told him that he ought to succeed but that he must consider certain items of expense that would cut down his profits. These I jotted down offhand as: Insurance, waste and oils, factory requirements, rent, light, heat, power, repairs, bad debts, small tools and belting. And I mentioned the certain amount of bookkeeping, the capital and interest tied up, and the necessity for setting aside a fixed sum for replacements. A week later he came in and said he had given up the idea of "being his own boss" and sharing in the losses.

There are not the chances for advancement in some plants that there are in others, and the same is true of wages. But money alone is not everything. Good treatment and opportunities to learn something besides routine operations count for a great deal, and in the end a man may be just as well off.

The nursed grievance may disappear with an exchange of ideas. Before harboring a grievance every one should make a fair and impartial analysis to see if the grievance is not a weakness or a fault with one's own self. No matter how low the wage, the employer always pays it and pays it in genuine money, not counterfeit—but is the time always genuine; is there not a forty-minute hour passed off for a sixty? Will the promised quality of work be turned out a month after the advance has been granted, or will we drop back to the old, easy rate? Yes, there are two sides to every question, and each will bear presentation.

SWINGING TOOL FOR RECESSING AND SIMILAR OPERATION

By F. Scriber

A swinging tool that is a convenient auxiliary for a hand turret lathe is shown by Fig. 1 of the accompanying illustrations, while a group of cutters used in this tool are shown by Fig. 2.

Its construction can best be explained by referring to a practical working example, and Fig. 1 shows at the left of the tool proper a section of a part which has a double recess cut into it, this being indicated at X. The shank A is gripped in the turret of the lathe in the usual manner, it having a flange B forged on it to which is attached the swinging block C. This block is mounted on a stud D, a bushing being used in the swinging part, also nut and washer to keep it in place. At E a pin is located and an elongated clearance slot is cut into the swing part to clear this stud, while two screws F with check nuts on them limit the movements of this part, which is operated radially by the operator pushing over handle H, a spring attached to pins G being used to pull the tool back into central position. A split bushing J with binding screw K for clamping the cutters in position completes this tool, it being obvious that split bushings having different sizes of holes can be used for gripping different cutters.

In operation the turret with tool is fed till the cutter is the correct depth in the work and the recessing is done by pushing handle H, thus forcing the cutter L into the work the required depth, which is governed by screw F, thereby the work is machined to the shape of the cutter.

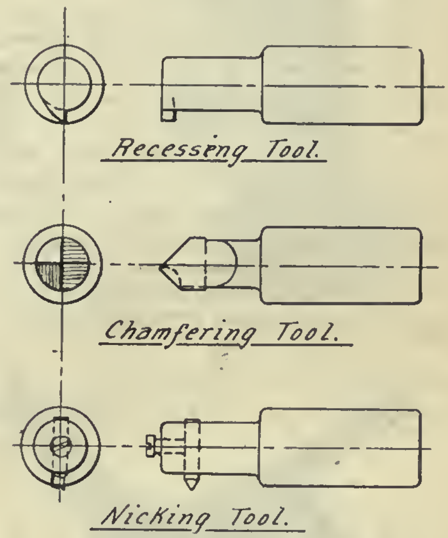
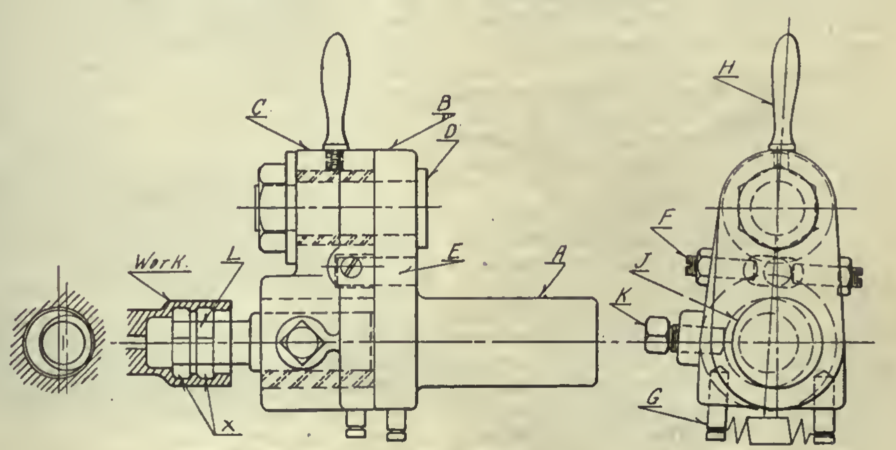


FIG. 2. DIFFERENT TYPES OF TOOLS

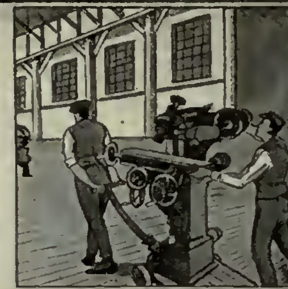
Referring to Fig. 2, the upper views show a plain necking tool or cutter such as is used for recessing back of a thread. The views at the centre show a type of chamfering tool for breaking corners, centering, etc., while the lower views show a pin cutter and bar used for cutting internal oil rings by the same method.

When it is desired to use this holder for boring, screws F are adjusted until the whole arrangement is prevented from swinging by having both screws come in contact with pin E.



GENERAL VIEW OF THE RECESSING TOOL

DEVELOPMENTS IN SHOP EQUIPMENT



WAHLSTROM TAPPING ATTACHMENT

The Wahlstrom Tool Co., 5520 Second Ave., Brooklyn, New York, have placed on the market their automatic tapping attachment as illustrated.

This attachment imitates hand tapping but is at least ten times faster, and handles all sizes of taps up to ½ in. The hand-tapping movement is obtained by means of steel gears so arranged as to provide an oscillating movement, the backward movement clearing the chips, thus saving the taps.

GENERAL VIEW OF THE TAPPING ATTACHMENT

The forward movement being greater than the backward movement advances the tap, while the return movement is continuous and works at an increased speed. With this attachment there is no danger of stripping the thread.

No springs are used, the movement being absolutely mechanical. The taps from the smallest to largest size are driven positively, without any adjustment being necessary.

If tapping cast iron or soft material, you can, by turning a knob on the attachment, make the movement continuous in place of oscillating.

All parts are of steel, hardened and ground throughout. There is nothing to get out of order, and every part is carefully machined to place. This device is handled by the Aikenhead Hardware Ltd., 17, 21 Temperance Street, Toronto, Canada.

MORRIS RADIAL DRILL

The Morris Machine Tool Co., Cincinnati, Ohio, have placed on the market what is known as their line of Morris 2½ ft., 3 ft., and 3½ ft. radial drills. These machines have certain distinctive features as follows:

At Fig. 1 and 2 is illustrated the front and rear view of head, which is heavily constructed and, at the same time, exactly balanced on the ways of the arm, permitting it to travel freely. An extra wide tapered gib is provided to take up wear. The head is moved along the arm by means of a rack and pinion, reduction gears and a handwheel on the left-hand side at the lower part of the head. This places it in reach of the operator when the arm is in its highest position. The head is clamped by two screws operated by one handle against the gib. One of the principal features is the helical spindle gears.

The angle of the teeth is enough to have more than one tooth meshing at one time and to avoid end thrust. The result is a constant power factor at the cutting point of the tool. eliminating the slight chatter effect usual with spur gears. It also means a more quiet drive and a stronger gear. Other features are, the enclosed spindle and sleeve, enclosed gears, tapping attachment gears and reversing clutch running continually in a bath of oil, and the graduated depth gauge, which trips the spindle feed at the desired depth. The column is made of semi-steel and is ground true to size. It is supported by both a large ball-bearing and roller-bearing in the stump, where it is rigidly clamped. This construction permits the arm to swing with exceptional ease, and when clamped is as rigid as a radial column and stump can be constructed. Both column and stump are extra heavy, insuring this rigidity. The base on these machines is so constructed that the speed box, cone pulley or variable speed motor drives are interchangeable.

The arm is designed to properly resist torsional and lifting strains. It slides on the column, having a long bearing, and can be clamped in any position by one lever convenient to the operator. The ways are wide, giving the head a generous bearing to slide on. The arm is raised and lowered by power through the lever at the top of the column.

The back gears are mounted in a fully-enclosed bracket directly in back of the head. All gears are of steel and the sliding engaging gears and clutches are of three and one-half per cent. nickel steel, heat-treated and hardened. Through these gears two speeds are obtained by a lever on the left-hand side of the head, convenient to the operator. Reversing gears and friction clutches are mounted in the same bracket, fully enclosed and run in oil. Lever controlling the reversing or tapping attachment is at the lower right-hand side of head, within easy reach of the operator.

The spindle is a hammered forging of high carbon steel ground true to size. Thrust is taken care of by a ball thrust bearing.

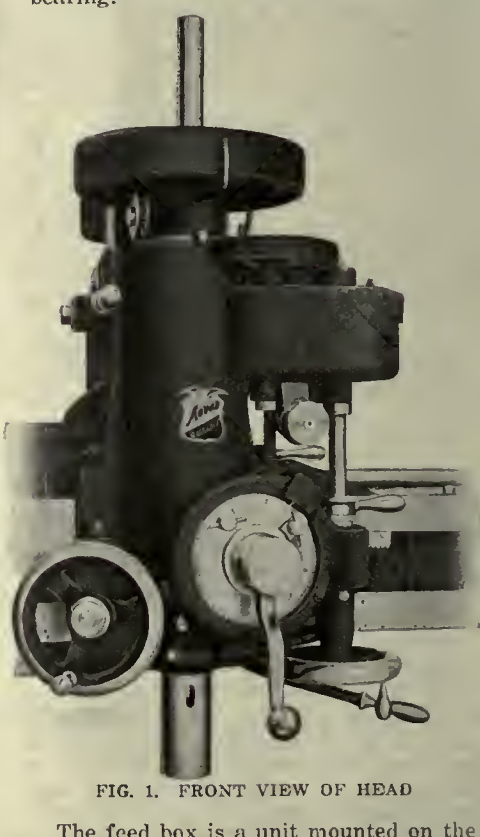


FIG. 1. FRONT VIEW OF HEAD

The feed box is a unit mounted on the head. Feed gears are fully enclosed and run in heavy oil. Four feeds are obtained and are marked on a dial in thousandths advance per revolution of spindle. Feed can be automatically tripped at any depth within the traverse of the spindle.

The gears are made of steel, except the large spindle gear which is made of semi-steel. Spur gears are hobbed and bevel gears are generated theoretically correct on a gear shaper.

The speed box is mounted on the base. Gears are fully enclosed and run in a light grease or heavy oil. Six speeds are secured, three through the vertical lever on the top of the box. This lever controls the double friction clutch on the

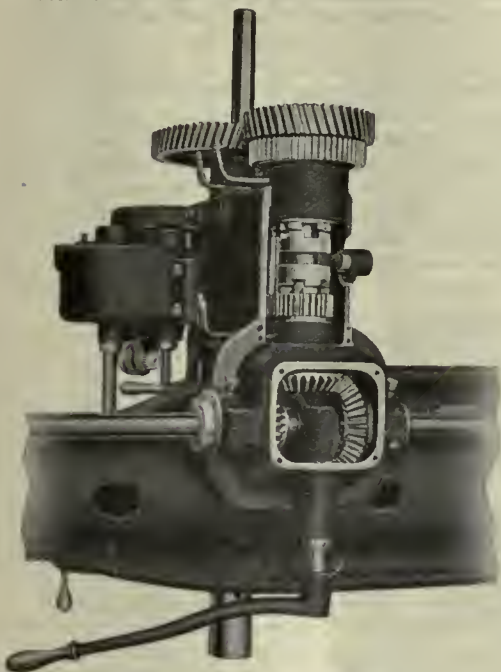


FIG. 2. REAR VIEW OF HEAD

pulley shaft, and when in neutral position stops every revolving part except the pulley shaft.

Friction clutches in speed box and tapping attachment are of the expanding ring type. Rings are ground in an expanded position insuring true contact when thrown in. They are of large diameter and wide face and capable of a pulling power considerably greater than the capacity of the machine.

The bearings throughout are of bronze, arranged with oil chamber, the oil being drawn into the bearing by a felt wiper.

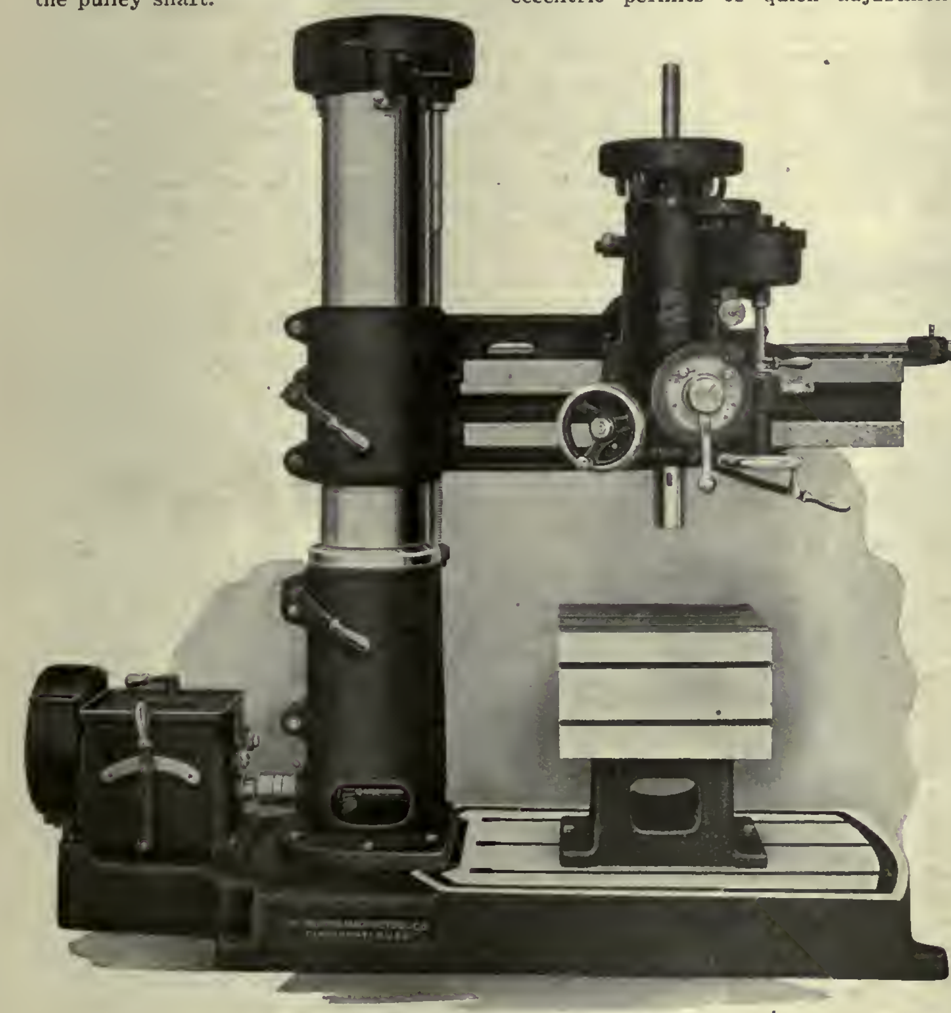
Motor drive can be arranged if desired.

AUTOMATIC SAW GRINDER

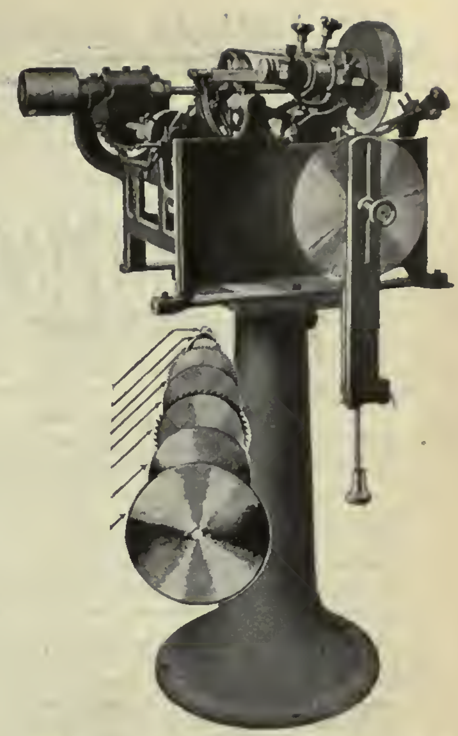
The Wardell Manufacturing Co., of Cleveland, Ohio, have now placed on the market their model E automatic metal cutting circular saw grinder. This machine is claimed to be the only one that will resharpen all screw-slotting, slitting, and cold saws from 1½ in. to 18 in. diameter, with teeth from 36 to the inch up to 2 inches from point to point.

It seems a general rule that saws are carelessly thrown away when dull, but with the machine shown the saws can be sharpened indefinitely.

Saws are resharpened at a speed of 45 teeth per minute. The machine is full automatic, and once started needs no further attention. A scaled slotted eccentric permits of quick adjustment



GENERAL VIEW OF THE DRILL



GENERAL VIEW OF THE SAW GRINDER.

of the feed, and a double pawl positive feed movement gives a continuous feed of the saw, even where teeth are broken out.

TRADE OPPORTUNITY IN CUBA

The old-established British firm of Albert Moloney and Co., 12 Amargura St., Havana, Cuba, is anxious to obtain sole agencies in Cuba for the following heavy machinery manufactured in Canada: Return tubular boilers, water-tube boilers, condensers, surface, jet, and barometric, power pumps of all types, steam driven, motor and belted, vacuum pumps, steam engines, valves and fittings, electrical generators and motors.

Canadian manufacturers might bear in mind that Americans enjoy a preferential tariff in Cuba, but that this is more than offset at the present time by the discount on the Canadian dollar. Another substantial assistance to Canadian trade with Cuba is the recent establishment of a direct line of the Canadian Government Merchant Marine between Canadian ports and Havana.

According to an article by Dr. Henry T. Eddy in the "Journal" of the Franklin Institute, uniformly reinforced concrete beams loaded at the one-third points store some 60 per cent. or more of the total energy of flexure in the steel reinforcement alone, and only about half as much in longitudinal compression in the concrete. Uniformly loaded flat slab floors with four-way reinforcement store only about 12.5 per cent. of the total energy of flexure in the slab steel. Since this is only about one-fifth of the amount stored in beams, the author states that it evidently is impossible to compute slabs by beam theory.

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PRINCIPAL CONTENTS

The Exchange Situation

IT may be that some United States firms doing business in Canada do not appreciate the feeling that exists here in regard to the peculiar situation that has been created following the war.

Let us get back to first principles. During the war Britain and Canada did the same thing, namely, they bought right and left, wherever they could secure the supplies and the materials they needed to carry on the conflict. It was a matter of life and death at that time. There was no chance whatever to sit back and reckon on the finer points of trade balances: It was a case of go on or go under, and Britain and Canada chose to go on, and they have been doing so ever since. Right there and right under those conditions Britain and Canada got a bad start in the adverse balance of trade.

Now we are not putting this forward so that United States sympathy should be appealed to on behalf of Canadian trade. Far from it. Canada can shake out with natural resources, with available acreage, and with undeveloped wealth and pay dollar for dollar with United States. We simply wish to state that this is the point from which many a Canadian business man views the exchange situation in its exaggerated and lop-sided condition to-day.

In order that we may give our American friends the benefit of what is being said in the machine tool trade in this country we are giving here the views of two prominent Canadian dealers. Both of them do a large amount of business with American houses. The first one:

"United States houses that are looking to this country to furnish them with business in the days to come should realize that the measure of their future business here is going to be largely the measure of co-operation they give to us at the present moment in trying to meet the exchange situation. There are firms that seem to think it is a matter over which we should worry, and we are doing all the worrying, and paying all the losses. On the other hand we have principals in United States that are showing the keenest desire in our welfare at this time. They realize what we are up against, and they have in several cases opened accounts here where our customers can pay their accounts at 100 cents on the dollar. I tell you, we are out for business for these firms, and in future we are going to give them selling service that will repay them for their decency at this time. I am sorry to say that, opposed to this class, we have some American principals whose chief interest in the exchange situation seems to be that they should be careful to carve off the last half per cent. exchange at whatever figure the fluctuating price for the day may be. I am not making any threats, but it is easy to see to which class we are going to turn for dealings in the future."

Here is the second case. These are both concerns that have large, active selling organizations:

"Exchange is hurting us now, in fact it is losing money for us. Some months ago we quoted on enquiries that were in the Canadian market and we allowed what appeared to be ample for exchange. Now, these shipments are arriving. What happens? The increase in exchange amounts to more than our profit on the deal, and we are losing the difference out of our own pockets."

Of course, it is very easy to sit back and say that the latter case should not have given a definite price. That does not alter the case at all. The price was given, and it was right and reasonable to give it, and what appeared at that time to be reasonable protection against exchange was put in. Events that no one foresaw have obliterated that apparent margin of safety, and we find the Canadian firm that got out and sold the American goods delivering the same at a loss because it is considered good business by the firm to reaffirm its belief in the fact that a contract is a contract.

CANADIAN MACHINERY, in all seriousness, would ask its American friends to think seriously and carefully over these matters. Conditions are being built in these trying times that are going to direct the course and current of business in years to come. The far-sighted firm is going to see that this rich market is worth something more than the monetary consideration of an added percentage that can be secured under passing and temporary conditions.

An Error in Topography

A WRITER in an American contemporary, speaking of a new 15,000-ton steamer now building for the White Star-Dominion Line, says that she is to be named the "Calgary," after the Canadian province in which the Prince of Wales owns a ranch. This reminds us of an old lady, who, after listening all evening to a traveller's tales of the Orient, remarked, "Yes, China must be a wonderful city."

"CAN any of you tell me what the late ruler of Russia was called?" asked the teacher. "The Czar!" roared the class. "And what was the Czar's wife known as?" Only two voices answered this time: "The Czarina." "Ah!" said the teacher, eyeing his flock fondly. "That is very good. Now, who will tell me what the Czar's children were called?" "Czardines!" yelled one little boy.

PASSING a hand over his forehead, the worried drill-sergeant paused for breath as he surveyed the knock-kneed recruit. Then he pointed a scornful finger. "No," he declared, "you're hopeless. You'll never make a soldier. Look at you now. The top 'alf of your legs is standin' to attention, an' the bottom 'alf is standin' at ease!"

"CLOSING the saloons has brought great changes."

"You bet," said the other dry-town inhabitant. "Nowadays a woman doesn't know where to find her husband."

A Giant in Chains

A CANADIAN who happened to be in New York during the past two weeks must have wondered at the acute paralysis developed by that city when attacked by a snowstorm. Granted that it was a fairly heavy snowstorm, its proportions were such that cities like Toronto or Montreal would have passed by without remark. The giant city of New York, which our neighbors are fond of calling the wonder city of the world, threw up its hands and murmured "Kismet," while its thousands of city dwellers and commuters spent hours in endeavoring to reach their homes, or else gave up the attempt, and spent the night as best they could in the city. Those who succeeded in reaching home remained there for several days in many cases before finding means to reach the city. The first means of conveyance to go out of business were the surface electric cars, they being handicapped by the fact that the current-bearing rail is under ground, a narrow slot in the centre of the tracks being left for the conductor to the car. This slot promptly filled up when the snow began to fall, and the cars just died on the tracks. For seven days not a street car ran. The elevated also was tied up considerably, and the power plants were short of coal due to the fact that communication with New Jersey by river became almost impossible due to masses of drifting ice coming down the Hudson. The subway was the only means of communication that kept up any kind of regular service. Motor vehicle traffic on all but the widest streets was suspended for days, and those cars and trucks that could run, received such abuse that they soon had to make for the garage for repairs. The scene in the down-town streets, in that congested section from the Battery up to Canal Street, was remarkable. The narrow streets with their high buildings, made admirable ravines for the snow to pack in, and broken-down and abandoned trucks and cars littered them as in the track of a hurriedly retreating army. For the first three days following the storm there seemed to be no definite and co-ordinated attempt to tackle the problem. Groups of men widely scattered could be seen making dispirited attempts to form a passage for vehicles. Hanging round every group was a sneaky individual who whispered to the men that they should not dream of working for less than $1 per hour, advice which seemed to be good to the men engaged. As late as last Saturday, ten days after the storm, the city was frantically calling for men to come and dig it out of the snow. The remarkable part of the whole thing seems to be that although snow is by no means unknown in New York, there does not seem to be any organization or equipment in the big town to tackle it when it does come. It was estimated by the merchants that they were losing $5,000,000 per day due to the tie-up, to say nothing of the damage done to rolling stock. Several fatal and near fatal fires occurred owing to the inability of the fire brigade to reach the scene over the blocked streets. The most amusing sight of the many to a Canadian was that of an old Jehu who had from some unknown old stable resurrected a two-seated sleigh, and a broken-down horse, and was offering sleigh rides to the populace for the small price of 50 cents for a five minutes' ride. The residents of Gotham congregated around this unusual sight and stared with great interest, and some of the more venturesome took 50 cents' worth. Truly New York is the wonder city, but they should send their Commissioner of works to Montreal or Toronto and see what we do with our snow.

Fuel Alcohol

IT has been said that the fuel resources of the world both as regards coal and oil are sufficient unto the present day and that regard for the comfort and convenience of future generations is a bit too altruistic. In other words we should trust to a kind Providence or to man's ingenuity and inventiveness for the circumventing of a future shortage of coal. While this is true and while it is also true that the present known resources in the way of coal and oil will last for some little time to come it is also true that long before exhaustion takes place, prices will have advanced to such a point as to render conservation in the strictest sense advisable.

To-day even coal and oil are far more expensive than anyone thought possible a few years ago and increasing attention is being given to other forms of fuel.

Low grade lignites and other material formerly of little value are now being used and industrial alcohol is being recognized as a cheap and valuable fuel for the internal combustion engine. The Advisory Research Council in Canada published a report on the use of industrial alcohol some little time ago and a recent report states that the Dominion Government is contemplating the removal of restrictions on its manufacture and will free it from excise duties.

The importance of this step can scarcely be overestimated, for the production of alcohol may be likened to the use of our waterpowers—water over the dam is lost forever and undeveloped waterpowers have to be paid for in the use of fuels which when once mined can never be replaced. In like manner the raw materials from which the alcohol can be obtained are now wasted, wood waste is allowed to rot or is burned, vegetable waste of the farm or city garbage is treated similarly and the sulphite liquor of the pulp mill is turned into the nearest stream to the pollution of the waters and the injury of all aqueous life. This latter source of alcohol, in passing, would provide an enormous quantity of alcohol for industrial purposes at a very reasonable price.

Probably the greatest immediate use for alcohol would be in the form of motor spirit and in this alone its use would render Canada more self contained, rendering her independent of foreign sources of supply, incidentally to the material benefit of the exchange situation. Tests have shown that alcohol is an admirable source of heat energy and any engine at present using gasoline may be run equally well on alcohol, although an increase in power of about 20 per cent. can be obtained by redesigning.

An interesting feature in connection with the world-wide shortage of fuel is the appointment in England of Sir Frederic Nathan as power alcohol investigation officer under the Fuel Research Board.

THE QUESTION IS—"WHEN WILL THEY GET DIZZY?"

MARKET DEVELOPMENTS

Flu and Exchange Are in the Limelight

Bothering Business This Week in a Good Many Ways—Prices Again Are Increased and Material Is Very Scarce—Steel Mills Are Short of Their Coal and Coke Supplies

THERE is no doubt a feeling of "we don't know" in the market this week, and it finds its echo in steel, iron, machine tools or small tools. The exchange question is a hackneyed affair, but it is a real circumstance just now. It means a loss of business in the way of booking, and a loss of money on orders that have been quoted by dealers at a definite figure.

Influenza is hitting the industrial world hard this week. There are plants with from two to three hundred workers out, and, of course, production is suffering accordingly. In spite of all these conditions, dealers report a good inquiry and a satisfactory volume of sales as a result.

The steel situation is serious, and it grows more so. There is nothing in sight to show any improvement. Steel mills in Canada are having a hard session trying to find the necessary coke or coal to keep their plants going. As sheets from Canadian mills are about all the relief that is coming in this much-wanted line, a shutdown would be a serious affair.

Several warehouse men from Toronto district have been in the steel mill belt of United States during the past few days. They went to see if they could not get their business on the mill books, and also in the hope of picking up any stray tonnage. In both quests they were disappointed.

Many of the consumers of steel in its various points are being hard pressed to find the supplies necessary to keep their plants going. In common with dealers and warehousing interests, they complain that under present conditions it is impossible to lay out a programme for the year's operations, as they know from past experience that they cannot adhere to it.

The scrap metal trade is very quiet. Mills and foundries seem to have dropped out of the market entirely. There is a very keen demand, though, for cast iron scrap, and lots of this will always bring plenty of buyers, regardless of other market conditions.

MONTREAL SAYS EXCHANGE RATE IS PUTTING BRAKES ON BUSINESS

Special to CANADIAN MACHINERY.

MONTREAL, Feb. 19.—The all-absorbing question of the moment is the slowing up of normal business, as a result of the exchange situation. While the effect in some quarters is not very pronounced, the consequence has been more or less serious, and is particularly emphasized in industrial circles, where it is virtually imperative to bring needed material in from the States. An example of what is taking place might be cited in the experience of a dealer here who quoted on a large machine list for a Canadian railroad. The equipment involved an expenditure of upwards of \$300,000, but when it was learned that nearly \$25,000 of this would be required to cover the exchange charges, the reply was "nothing doing." If no better arrangements could be made, the purchase of the machinery would be diverted to Canadian manufacturers, where possible, and such machines as required to come in from the States would be held in abeyance until trading conditions became more normal. This appears to be the general situation and while considerable business is still carried on, the bulk of it is of essential character. Some dealers here have been negotiating with their American principals in an effort to induce them to co-operate in carrying the burden of the high exchange. In this they have been partly successful, particularly with those lines that are open to the trade, many of the makers of these lines agreeing to absorb the full amount of the exchange. In the case of exclusive agencies, the assistance is varied, the majority deciding to take care of all exchange over 4 per cent.

Plates and Sheets Advance

Despite the announcement a few weeks ago that the steel strike was declared over, the resultant relief has not been one that would indicate that mill production has shown any material increase. Many reasons are advanced for the shortage of material, such as car shortage, scarcity of raw materials, inefficient help, etc., but it is still a glaring fact that delivery of material is a disturbing factor in industrial activity, and the consumer is far from satisfied. No assurance will be given as to the expected date of delivery and normal acceptance of business is the placing of the orders on the books, with no definite promise as to time of shipment. Even premium business is less pronounced, owing to the inability to get producers to handle the same.

The plate and sheet situation is now beyond the knowledge of the average dealer and obtainable information is of a very indefinite character. Warehouse supplies on ordinary sizes are now a matter of history and little relief is looked for in the early future. Montreal quotations on plates have been marked up, but more as a result of habit than a definite message to the trade, as present circumstances allow of normal prices only, each individual sale determining the actual trading figure. Asked as to what was being quoted on sheets, one dealer replied, "Anything we can get," but for the sake of relative guidance, they are quoting \$8.25 on black 28, and \$7.75 on black 10 gauge; these prices represent an advance of 1¼ cents per lb.

Nervousness Pronounced

Dealers are loath to commit themselves on the actual scrap situation, for the specific reason that it is very difficult to make a definite statement of conditions as they exist to-day. The question of price on some essential lines is now secondary to supply and dealers are open to consider offers when material is available. This is particularly true respecting machinery scrap, and the figure of $26 is only nominal, as dealers intimate that a price will only be considered when a sale is negotiated. The entire old material market is pregnant with nervousness and uncertainty.

SHORTAGE HAS BECOME MARKED

Conditions Grow Serious in Some Lines With No Relief in Sight

TORONTO.—Several influences are at work just now with the apparent intention of stopping business in this district. One of them has been here for some time, viz., shortage of supplies, and the other, although only here a short time, has been making its presence felt —the "flu."

There are a number of plants in this district that are badly handicapped because they cannot get their supplies of raw material. This refers especially to those that use large quantities of steel in any of its various forms. There is a serious situation right here, and it is only by very careful handling and apportioning of the available stock that plants are keeping in operation at all.

The "flu" epidemic is playing havoc with the available labor power in a good many places. Large plants report from two to three hundred hands off this week. This tends to curtail operations, but dealers in small tools report that they do not notice any falling off in the amount of business they are doing, which might be expected from a letting-up in the shop operations in the district.

"There is a good inquiry list coming in now," stated one dealer to CANADIAN MACHINERY this morning, "and what is better, some of our principals in the United States are showing a little betterment in their delivery schedules, and an increasing desire to do all in their power to make it as easy as possible for their Canadian customers to deal effectively with the exchange situation. They realize—some of them do at least—that if they intend to carry on here in years to come they will have to show a very marked desire to act in the utmost good faith in the present unsettling times."

Report Business Brisk

Three dealers in small tools reported this morning that they were doing a nice volume of trade. The order for many of the supplies for the St. Malo shops of the National Railways is being placed this week. The last list is largely carbon drills. It is understood that the business is being pretty well split up as it seems to be the policy of the railroads in their buying to do this. The limit price for large quantities is generally given to the railways, so here is one case, at least, where the Government does its buying at rock-bottom figures. The only complaint some of the dealers have about the Government railway business in tools and supplies is that the money for the goods comes slowly, and very often they are required to tie up their own money on a sale where they have given the very lowest possible figure.

The Steel Market

Little good can be done in trying to make it appear that conditions are improving in the steel market. Manufacturers and consumers of steel in any form know that such is not the case. Several Toronto warehousemen have been down in the steel mill belt of the United States, seeing what they could pick up in the way of ready shipments, or using what influence they had to try and get some of their bookings on the go. They all come back with the same opinion of the situation. They are not at all enthusiastic over the outlook. The shipping is slow. In fact the Canadian office of the Steel Corporation states that they have in all some 150,000 tons in the Corporation's various yards that cannot be moved to the consumers. Some of the smaller mills of the Corporation have been forced to close during the last few days on account of shortage of material, principally coal and coke. Canadian mills are suffering from the same cause. The situation in the Dominion steel industry is one that is causing no small concern. Supplies of coal that must be forthcoming daily to keep the coking plants in operation are being confiscated before they ever reach the border. Close off the coking plants and the blast furnaces, open hearths and the finishing mills will not run very long. This is especially true at present as there is very little steel in the semi-finished stage in any of the yards, as the entire hearth capacity has been drawn on by the capacity operations of all the finishing departments.

The situation just now is confusing to warehousing interests and to manufacturers alike. They are finding it particularly hard to lay out any concerted programme for the year's operations, because they cannot count on supplies coming through. The automobile industry in this district is finding it hard to secure several things, perhaps nothing so much so as springs for the making of upholstered seats. Steel for running boards, bodies, etc., is also very scarce, and operations are curtailed as a result.

Canadian mills have announced to the trade an increase in bars, the resale price in the warehouses now being $5 per hundred base, and $5.50 for 3-16 and thinner.

"Flu" Bothers Scrap Trade

Reports to CANADIAN MACHINERY indicate that the "flu" has hit the scrap yards. Business has fallen away off this week, was the report of the largest yard in this district. Not only in this immediate territory, but all over, the buying is away off, and the only demand is for export.

Prices remain the same. There is very little moving at present in reds and yellows. Cast iron is just as scarce as ever, and the man who happens to be holding any just now is in the rather enviable position of being able to dictate his own terms and conditions and price. The fact that under these favorable selling conditions very little of it is being unearthed goes to show that the shortage is bona fide, and not due to manipulation or withdrawing from trade.

POINTS IN WEEK'S MARKETING NOTES

Bars are up again, iron and steel base now being $5 per hundred Toronto, with $5.50 for 3-16 and thinner.

Shortage of coal is keeping Canadian steel mills on the keen edge.

Automobile makers find it hard to secure springs for upholstering seats.

"Flu" is invading Toronto industries now, many of the larger places reporting from 200 to 300 off.

Buyers from Ontario have made several trips to the steel district of the States in search of material, but without success.

Thousands of tons of finished steel are at the plants of the U. S. Steel Corporation, awaiting removal.

Scrap metal markets are dull, but there is a great scarcity in cast iron, and a good price can be secured for this.

Dominion Oxygen Company Will Have a Plant in Toronto

Toronto.—The growth of the oxy-acetylene industry in Canada is evidenced by the recent organization in the city of the Dominion Oxygen Company, Ltd., which aims to meet the greatly increased demand for oxygen, and other gases used in industrial plants. This company is a subsidiary of the Union Carbide and Carbon Corporation which controls 36 distinct companies throughout Canada and the United States. The officers of the company are: President, B. O'Shea; vice-presidents, Leighton McCarthy and E. S. Whitney; treasurer, Silas Wiley; secretary, J. R. Knapp. The building programme provides for the immediate erection of five large oxygen plants, one of which will be at Toronto, with others in leading industrial centres. In addition, service stations and warehouses will be established throughout Canada to supply the smaller industrial centres. The formation of this company is an added proof of the great growth of the iron and steel industries in Canada, as the demand for the oxy-acetylene process is but an outgrowth of the other industry.

MACHINE TOOL ENQUIRIES SLACKEN BUT SOME FIRMS STILL IN MARKET

Special to CANADIAN MACHINERY.

NEW YORK, Feb. 18.—It is somewhat difficult to analyze the machine-tool situation at the present writing. Evidence of a lull in buying and in inquiries has been noticed in the past week, and following the disturbance in the financial markets this naturally leads to the assumption that manufacturers are pursuing a more cautious policy. However, the epidemic of influenza and the tie-up of transportation due to recent heavy snowstorms, may have had something to do with bringing about a lull. It will take more than one or two weeks of quiet to determine whether most of the buying of equipment for the country's amazing industrial expansion has been done. Most of those in the trade believe that the lull is but a temporary condition, and that as soon as spring comes business will go forward with a rush. There is much to support this view, so far as the metal-working industries are concerned, in the large number of new manufacturing projects which are every day coming to light. New steel plants and rolling mills are a conspicuous feature of recent industrial planning.

Prices on many commodities have gotten so high that a break is bound to come sooner or later, and in the past few weeks there have been slight declines in food products and in some textiles. Any pronounced break in prices in any line of commodities would be reflected eventually in the metal-working industries, and this possibility is, of course, being watched for very closely.

The Columbia Graphophone Co., Bridgeport, Conn., continues to buy for its Toronto and Baltimore plants. The Willys Corporation, Elizabeth, N.J., is still adding to its equipment. There is considerable activity also in New England, one of the most important inquiries coming from the Saco-Lowell shops, Boston, for several hundred thousand dollars' worth of equipment. The Eisemann Magneto Co., Brooklyn, N.Y., is buying on a fair-sized list. Business is made up largely, however, of small orders, and of these one dealer has received a sufficient number thus far to indicate that February will be an exceptionally good month. Other sellers report a very material falling off in business this month. So at best it may be said that conditions are spotty, as is to be expected during a period of uncertainty, such as has been brought about by the foreign exchange situation, the tightness of money and other related developments.

PIG IRON PRODUCTION INCREASES; SCRAP MARKET QUIET

Special to CANADIAN MACHINERY.

PITTSBURGH, Feb. 18.—The situation in the steel market as a whole remains as it was. There are some stabilizing influences, but there is in substance a runaway, as was apparent in the reports of a week ago. The United States Steel Corporation has no direct following in its adherence to March 21 steel prices, but two large independents are with it in theory to the extent that they are holding their products at prices substantially equal to the prices ruling before the March 21 reductions. All other sellers seem anxious to secure the highest steel prices obtainable.

Steel Ingot Production

According to the monthly report of the American Iron and Steel Institute, the production of steel ingots in January, 1920, by thirty companies which made about 84.03 per cent. of the total steel ingot production in 1918 amounted to 2,966,662 gross tons, as compared with 3,107,778 tons in January, 1919, a decrease of 141,116 tons. By processes the output in the two months was as follows: Open-hearth, 2,351,153 gross tons in January, 1919, and 2,241,318 gross tons in January, 1920; Bessemer, 749,346 gross tons in January, 1919, and 714,657 gross tons in January, 1920; all other, 7,279 gross tons in January, 1919, and 10,687 gross tons in January, 1920.

Surprise in Pig Iron Production

Much surprise has been expressed by the reports showing that pig iron production increased nearly 15 per cent. from December to January. Coke shortage and disorganized traffic conditions on the railroads had been the source of much complaint, so that the belief of a loss in production seemed to be well established. While the 15 per cent. increase was not expected, nevertheless it wasn't satisfactory, and much more than that is needed. Accumulations of finished steel are seen at many of the steel plants awaiting shipment and held back by reason of insufficient car supply. Some of these plants report accumulations of 50,000 to 75,000 tons, and it is safe to say that in the Central West there is more than half a million tons of material at plants awaiting shipment. This does not mean that the railroads are functioning less than formerly, but it looks as if they are unable to increase their service with anything like the rapidity desired by the iron and steel industry.

U. S. Steel Unfilled Obligations

This week the report of the United States Steel Corporation showed that its unfilled obligations had increased during January by 1,020,075 tons, this increase being about 10 per cent. less than the December increase, but on account of shipments having been heavier in January, say 84 per cent. of capacity against about 73 per cent. in December, the actual bookings were somewhat larger in the latter month. The actual bookings in January involved, in many cases, orders that were doubtless booked in November or December, but were held back pending a careful scrutiny of the customer's record, for much more tonnage is offered the corporation than it can accept.

Export Tin Plate Business

It is stated here that about $9.50 is the highest that has been done on any regular overseas export tin plate business, and if that is really the case it would indicate that sellers have not exacted the very highest prices possible, as with the Welsh market up to 70 shillings there is little doubt that somewhat higher prices could be obtained. One sale to Canada, however, has been made on a $10 basis. That is exceptional, since, as a rule the tin plate producers regard Canada as more or less a part of the domestic market. The last-named has been well held at the $7 level. The tin plate plants are operating on an average at from 75 to 85 per cent., there still being a shortage of sheet bars. There is a very serious shortage of box cars for shipping the product, but thus far the warehouse capacity of the mills has been ample to take care of the difference between production and shipments.

The Scrap Market

The iron and steel scrap market is very quiet, and prices have softened somewhat, a temporary condition due to the congestion at the different consuming plants. Prices are not varying much, although it is believed that in a few cases concessions have been made. There was little buying by the mills this week as they were heavy buyers two weeks ago, and this eased up the activity in the market. Dealers who last week were disposed to encourage the softening in the market were in the same mood this week, and held back from making bids for heavy melting steel, a policy that generally brings out odd lots at lower prices than the $28 possible in Pittsburgh some time ago. The several descriptions of re-rolling scrap that advanced last week have kept up, although very few actual transactions have been recorded.

Pig Iron Market

Bessemer and basic pig iron have both advanced in the week just ended, and the irregular nature of the advancing tendency is well illustrated by the fact that basic pig iron has passed Bessemer, although the last-named is the most expensive grade to make, and is always considered the most valuable. A week ago basic stood at $40 Valley, and Bessemer at $41. There was a larger tonnage demand for basic than for Bessemer, and when all the $40 iron was cleaned up there was still some buying, which promptly developed a jump in the quotation to $43. Bessemer remained at $41 until the middle of this week, when a sale of 3,000 tons was made, delivery over the next five months, at $42 valley, thus establishing the market at that figure. Demand for foundry iron seems to have quieted down, after furnaces had sold about one-third of their second half output at the regular market, recently developed at $40 valley. The furnaces now state, however, that they are out of the market and would not sell any more at the recent prices. A fresh movement may come in foundry iron, but basic now seems to be the more interesting commodity. The market is quotable as follows: Bessemer, $42; basic, $43; foundry, $40; malleable, $41.25.

While the total supply of coke has not increased to any great extent, it is not altogether as difficult as it was formerly to effect purchases. Some of the dealers state that while they have not been able to secure all the coke for their friends that was wanted they were able to pick up a fair quantity. The coke market remains quotable as follows: Furnace, $6; foundry, $7; crushed, over ¾ inch, $7.30. There has been a falling off in production in the Connellsville region, the loss this week showing 1,991 tons. Car shortage is given as the greatest reason for this.

MEETING AND SOLVING THE EXCHANGE SITUATION

THE subject of exchange has become a vital question among the big majority of business men here, who, through necessity, have to deal with manufacturers or other business interests in the States. Customers are very reluctant to purchase new equipment from American concerns on the understanding that they will be called upon to pay, in addition to the list price of the material, the exorbitant high rate of exchange existing at the present time. It will readily be seen that this condition is a very severe handicap to the handling and selling of the merchandise of American manufacture.

The situation is one that tends to prevent early expansion in many directions, and the American business house is in danger of losing his hold upon the Canadian market unless he takes prompt steps to remove the obstacle of high exchange that is now preventing the onward march of progress.

One of the industries that has received a full share of the resultant decline of business, as a direct consequence to the exchange problem, is the machine tool interests, and several of the larger Canadian houses have been in correspondence with their principals with the purpose of negotiating some practical method of bridging this widening chasm. In some instances, and the one generally accepted as the most effective, American tool manufacturers have opened accounts in Canadian banks to allow the purchase of equipment to obtain the full value of the money expended without being called upon to have it discounted at the prevailing rate. In this way the American manufacturer could conduct his sales in the ordinary manner, at the same time retaining the full confidence of the buyer. When the rate of exchange again becomes normal the funds could be withdrawn and transferred to the home office without loss.

Another suggested alternative is the investment by the American distributor in gilt-edged Canadian securities, bearing a good rate of interest such as the late issue of Canadian Victory bonds bearing interest at 5½ per cent. per annum and issued at par.

This appeal has been made in the interests of the American manufacturers as well as those of the Canadian buyer. It will enable the former to retain a hold on this market and will likewise facilitate the expansion and reconstruction of Canadian enterprise.

The response, it is learned, has become very favorable, as many Canadian interests, either by the methods above suggested, or others arranged by themselves, have agreed to co-operate in meeting the burden of the high exchange. Some are willing to absorb the full amount, and many others are offering to absorb all over what might be considered as a normal rate of exchange.

U.S. SCRAP METAL

The scrap iron market is not as firm as it has been of late. Prices have eased from their high position and buying has slackened. Following are reports from various U. S. points:

Chicago.—Heavy melting steel has gone back about 50 cents per ton. Pig iron is still short, and cast scrap is in consequence retaining its strength. Rolling mill grades are strong.

Boston.—There has been a general shading on all grades, but it does not amount to very much. Cast grades are keeping firm, while railroad wrought has brought $32. Turnings and borings are firm.

New York.—A quiet week has been experienced, largely due to climatic conditions tying up yards and railways. The market has remained firm with the exception of heavy melting steel.

Philadelphia.—There has been little business done during the week, the weather acting as a brake on most activities. Quotations remain as they were but the market is thought to be weaker.

Pittsburgh.—The market is still firm for foundry grades, especially cast scrap and special purpose material, but the steel grades have receded somewhat. Heavy melting has been quoted at $28.50 but no sales have been made.

Cleveland.—There is little doing in the scrap iron market here. Purchasers are stocked up for some little time ahead and are keeping out of the market. Heavy melting quoted at $26.50 to $27 is not selling. Cast iron borings are quoted at $20.

Buffalo.—There has been little business done during the week, a general tie-up resulting from shortage of cars and labor. The market has weakened a little but resumed business will no doubt bring prices back to their former level.

St. Louis.—The scrap iron and steel market has suddenly taken fright at the recent slump in foreign exchange, and seem to be doing nothing but sit tight. There is a good demand for scrap, and the foundries and mills are big consumers. Heavy melting is being held for $30 by dealers.

Birmingham.—There is a firm market here, though the withdrawing from the market for a couple of days of the steel consumers caused some anxiety. Some heavy melting was sold towards the end of the week at a slight price concession.

PIG IRON TRADE

With an active demand and supply scarce, both basic and foundry iron have made advances. Following are reports from various U. S. centres:

Pittsburgh.—About 20,000 tons basic has been sold recently at $43 valley furnace, an advance of $3 over previous sales. Delivery is mostly to start immediately. There is an active demand for basic, while foundry grades are around $43.75 for the basic grade. Malleable is not in as much demand as it has been, and a quotation of $42 met with no buyers.

New York.—Prices of pig iron are again on the rise, but the amount of buying is not so heavy as has been the case recently; 1.75 to 2.25 silicon for second half Buffalo was sold at $45. First half Virginia iron sold at $42 furnace for the basic grade. Some foundries have had to shut down recently through the storms tying up traffic.

Cleveland.—Basic is hard to obtain, and sales have been made as high as $44 valley furnace. Sales for the week in this district total around 250,000 tons, the average price being $41 furnace. Foundry iron is also feeling the effects of the high prices, and is now quoted from $41 to $43 for No. 2 foundry. The higher figure is for second quarter delivery.

Cincinnati.—The market is firm here, but the feeling is not quite so buoyant as it was. Furnaces are pretty well sold up. There is a wide spread in prices quoted, some having been offered at $40 Birmingham while as high as $45 has been asked. The car situation is serious.

Philadelphia.—There is an active enquiry for second quarter iron and also for second half. No. 2 iron is quoted $44 furnace for first half and $43 for second half. Basic has been quoted at $45 furnace, an advance of $5.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$33 00
Lake Superior, charcoal, Chicago	38 40
Standard low phos., Philadelphia	40 00-40 00
Bessemer, Pittsburgh	35 00
Basic, Valley furnace	30 00
Toronto price:—	
Silicon, 2.25% to 2.75%	47 30
No. 2 Foundry, 1.75 to 2.25%	45 95

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 4 75
Steel bars, base, Toronto	4 75
Iron bars, base, Montreal	4 75
Steel bars, base, Montreal	4 75
Reinforcing bars, base	4 75
Steel hoops	6 00
Norway iron	11 00
Tire steel	5 50
Spring steel	8 00
Band steel, No. 10 gauge and 3-16 in. base	5 25
Chequered floor plate, 3-16 in.	7 50
Chequered floor plate, ¼ in.	7 00
Staybolt iron	8 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 25
Tank plates, Pittsburgh	3 50
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 90
Small shapes under 3"	3 62

FREIGHT RATES

Pittsburgh to Following Points	Per 100 Pounds. C.L.	L.C.L.
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

	Gross. Montreal	Toronto
Lake copper	$25 50	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	71 00	60 00
Spelter	12 50	10 75
Lead	10 25	8 75
Antimony	14 00	10 50
Aluminum	33 00	35 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in	6 50	7 00
Plates, ¼ up	$ 6 00	$ 6 50

Price List No. 38

WROUGHT PIPES

Standard Buttweld

⅛ in.	$ 6 00	$ 8 00
¼ in.	4 68	6 81
⅜ in.	4 68	6 81
½ in.	6 21	7 78
¾ in.	7 82	9 95
1 in.	11 56	14 71
1¼ in.	15 64	19 90
1½ in.	18 70	23 76
2 in.	25 16	32 01
2½ in.	40 37	51 19
3 in.	52 79	66 94
3½ in.	67 16	84 18
4 in.	79 57	99 74

Standard Lapweld

2 in.	38 81	35 34
2½ in.	42 12	52 36
3 in.	55 08	68 47
3½ in.	69 00	86 94
4 in.	81 75	103 00
4½ in.	93	1 18
5 in.	1 08	1 37
6 in.	1 40	1 78
7 in.	1 83	2 32
8L in.	1 93	2 44
8 in.	2 22	2 81
9 in.	2 66	3 36
10L in.	2 46	3 12
10 in.	3 17	4 02

Terms 2% 30 days, approved credit.

Freight equalized on Chatham, Guelph, Hamilton, London, Montreal, Toronto, Welland.

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.
4½" and larger 50%.
4" and under, running thread, 30%.
Standard couplings, 4" and under, 40%, 4½" and larger, 20%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$14 00	13 75
Copper, crucible	17 00	17 00
Copper, heavy	17 00	17 00
Copper wire	17 00	17 00
No. 1 machine composition	15 25	16 00
New brass cuttings	11 00	10 75
Red brass cuttings	14 00	14 75
Yellow brass turnings	8 00	9 00
Light brass	6 25	7 00
Medium brass	7 25	7 75
Scrap zinc	6 00	6 00
Heavy lead	5 00	6 00
Tea lead	3 75	3 50
Aluminum	18 00	18 00
	Per Ton	Gross
Heavy melting steel	15 00	16 00
Boiler plate	15 00	11 00
Axles (wrought iron)	25 00	20 00
Rails (scrap)	16 00	16 00
Malleable scrap	25 00	20 00
No. 1 machine cast iron	26 00	25 00
Pipe, wrought	10 00	9 00
Car wheels	22 00	20 00
Steel Axles	21 00	20 00
Mach. shop turnings	9 00	11 00
Stove plate	22 00	21 00
Cast boring	10 00	11 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜" and less	15
Carriage bolts, 7-16 and up	Net
Coach and lag screws	30
Stove bolts	50
Wrought washers	50
Elevator bolts	5
Machine bolts, 7-16 and over	10
Machine bolts, ⅜" and less	20
Blank bolts	25
Bolt ends	10
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square blank	add $1.50
Nuts, square, tapped	add 1 75
Nuts, hex., blank	add 1 75
Nuts, hex., tapped	add 2 00
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent.
Set screws	40
Sq. and Hex. Head Cap Screws	35
Rd. and Fil. Head Cap Screws	5
Flat But. Hd. Cap Screws	10
Fin. and Semi-fin. nuts up to 1 in.	35
Fin. and Semi-fin. nuts, over 1 in., up to 1½ in.	25
Fin. and Semi-fin. nuts over 1½ in., up to 2 in.	10
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws list plus 20,	30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$43 00
Open-hearth billets	43 00
O.H. sheet bars	46 00
Forging billets	56 00
Wire rods	55 00

Government prices.
F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$4 95
Cut nails	5 00
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 32
British Manila rope	0 26
New Zealand hemp	0 26
Transmission rope, Manila	0 43
Cotton rope, ¼-in. and up	0 80

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CANADIAN MACHINERY
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MANUFACTURING NEWS

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Some Examples of Profile Milling Practice

This Subject is One Which the Average Mechanic Should be More Familiar With, as It Often Means Reduced Labor to Adopt This Practice. Various Fixtures Are Shown and Discussed

By F. SCRIBER

THE machining of odd-shaped parts from metal, always a troublesome job, is seldom accomplished in the most efficient manner—due, sometimes, to the necessity of providing formed cutters, and often because proper machines are not available. The profile and hand form milling machine, while a constant ally of gun makers, sewing machine manufacturers and others heavily engaged in hogging forms from metal, is to many others somewhat of a mystery, even though an old-timer on the market.

The purpose of this article is to describe the operation of this machine and present examples from practice, thereby, perhaps, suggesting a way out of form machining difficulties for someone.

A profile milling machine usually consists of one or two revolvable spindles, with guide pins, which are caused to follow master plates by means of two handles attached to feed screws operating slides working in planes at right angles to each other. Such a machine having two cutter spindles A is illustrated by Fig. 1. The handle B feeds slide C, while slide base D is fed by handle E in the opposite direction.

Referring to Fig. 2, this shows a section through the spindle of a profile milling machine, this spindle being carried in a suitable slide which is used to bring the cutter in contact with the work, suitable stops and adjusting screws being provided for that purpose. In the tubes F, Fig. 1, operating springs are located for these slides. Referring to Fig. 2, the cutter A is held in spindle B by draw bolt C, the spindle being of the usual adjustable box construction, and is driven by spiral gears.

Typical profiling jobs are the milling of cams, shoes of odd radius, gun magazine parts, etc., while by referring to Fig. 3 the usual manner of setting up the work in a fixture is illustrated, the means of holding same being, of course, that best adapted to the particular job being done. Referring to the illustration the cam is placed on a stud A, and is clamped by the nut B. An outline of the cam shape C is attached to the base of the fixture by screws and dowels D, and the fixture being attached to the table of the machine, the outline of the cam is milled by keeping a guide pin in contact with the formed plate in the manner previously described, the guide pin usually being held in the same slide as the cutter in hole at X, Fig. 1.

To compensate for wear of the milling cutter, the guide pin is beveled, and this necessitates a corresponding bevel on the formed plate. A fixture for milling a flat plate is illustrated by Fig. 4 This plate is located between blocks A and B, while it is clamped by strap C and

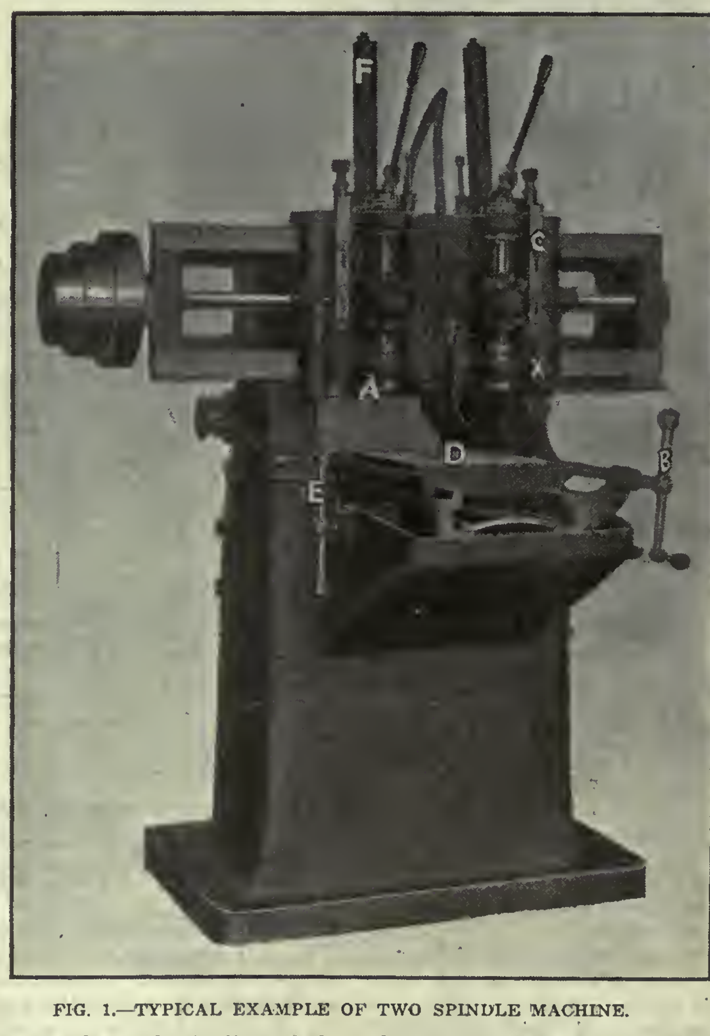


FIG. 1.—TYPICAL EXAMPLE OF TWO SPINDLE MACHINE.

nut D. The outline at X is milled in the customary manner, using plate E as a means of guiding the cutter.

Not all work can be handled by having the guide pin held in the same slide as the cutter, consequently recourse must be had at times to carrying the cutter in one slide and the guide pin in the other slide of a two-spindle profile milling machine. Such an arrangement is

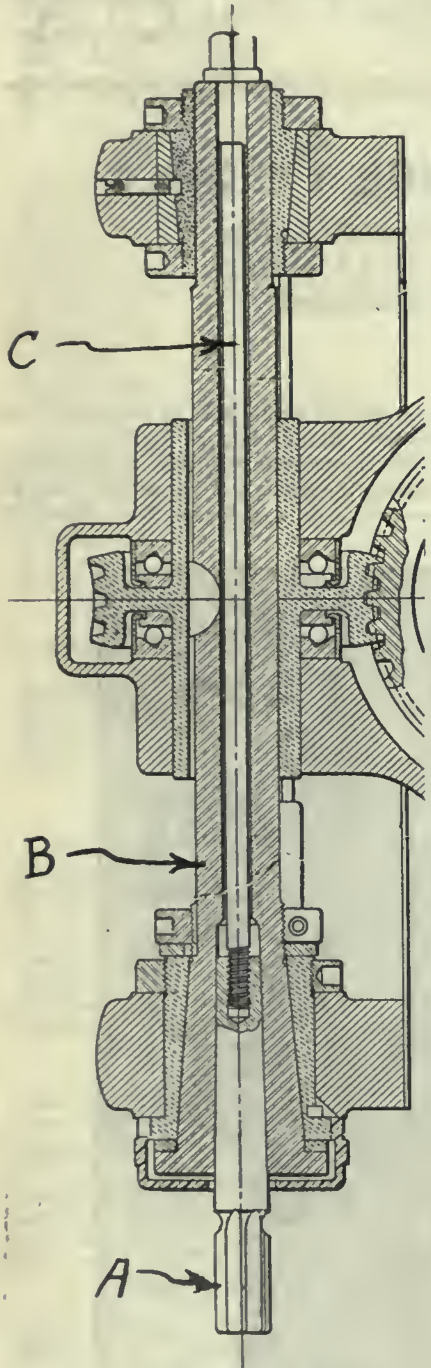


FIG. 2.—SECTION THROUGH SPINDLE.

illustrated by Fig. 5, where the cutter A is carried in spindle B and the guide pin is carried in spindle C.

It is necessary to lock both slides together, so they will work as one in a case of this kind.

As an instance of this application, reference is had to Fig. 6, where the method of milling the point of a bayonet is shown, in which instance the bayonet rests in a block A and on a formed plate B, while set screw C holds the bayonet against block D in a substantial manner. With the work thus secured a profiling cutter mills the outline at the point of the bayonet, using formed block E as a follower for the guide pin. The formed block and bayonet are so far apart in this case that the guide pin in the cutter spindle slide could not be used, therefore recourse was had to the method described in the proceeding paragraph.

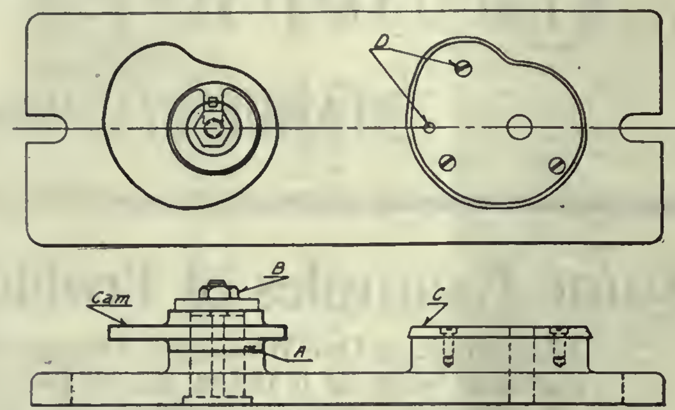


FIG. 3—TYPICAL EXAMPLE OF SET UP.

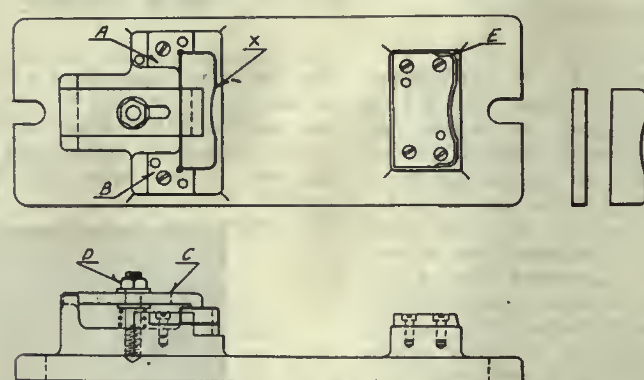


FIG. 4.—FIXTURE FOR MILLING FLAT PLATE.

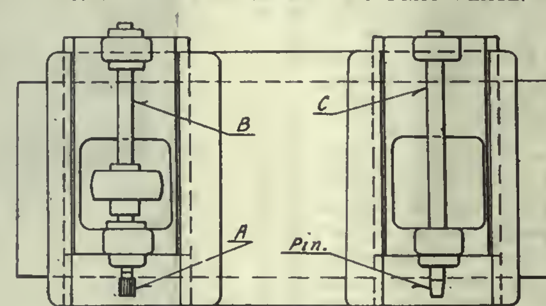


FIG. 5—ARRANGEMENT OF SPINDLES.

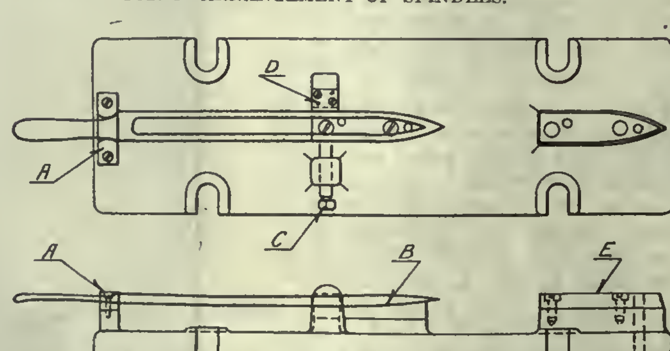


FIG. 6.—BAYONET POINT MILLING FIXTURE.

A great many times it is convenient to profile mill having the guiding means and cutter combined as one tool, likewise having the formed follower plate above or below the work. Such a condition is illustrated in Fig. 7, while by referring to the different types of cutters shown by Fig. 12, an idea of the method of handling will be obtained.

The fixture, Fig. 7, is a comparatively simple one, consisting of a cast iron base, A, finished top and bottom, while the work rests on the top and is located

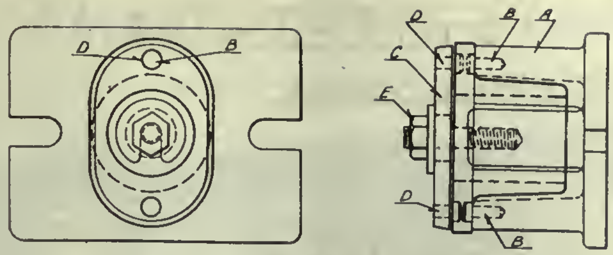


FIG. 7.—ANOTHER SIMPLE FIXTURE.

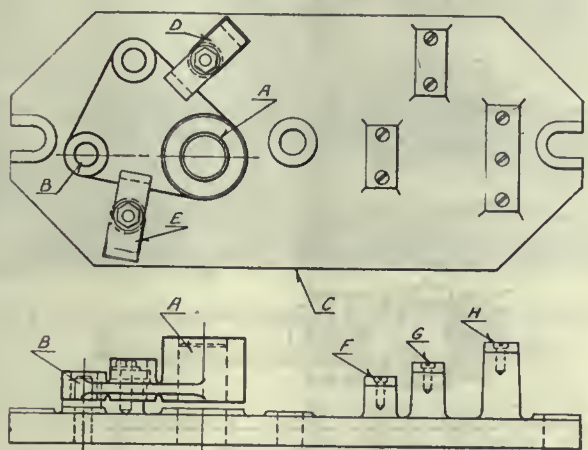


FIG. 9.—A FIXTURE FOR SURFACING THREE BOSSES.

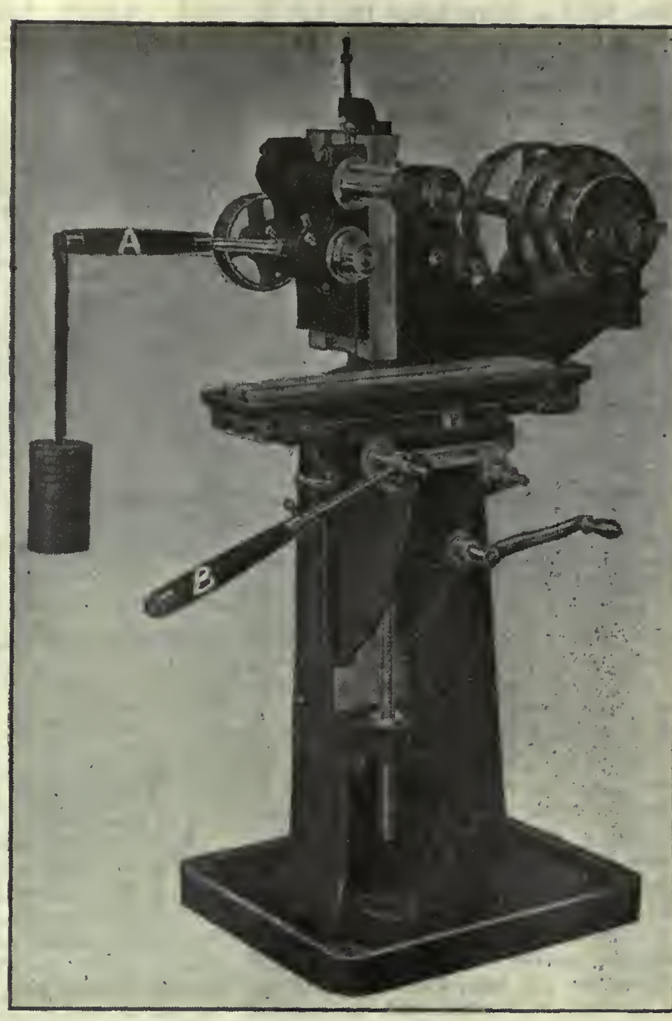


FIG. 8.—A HAND MILLING MACHINE.

by two pins, B. The plate C containing two pins D is located in these same holes, while the combination of stud, nut and washer E clamp the plate and work in position. With the fixture clamped to the table of the profiler, a cutter similar to that shown at C, Fig. 12, is employed, except that the guide roll is closer to the cutter Y. In operation the roll is kept in contact with the formed plate in the usual manner, thus permitting the cutter to form the outline of the work.

Figure 8 illustrates a hand-milling machine, by means of which irregular outlines are often machined, using cutters of the same general type as that just described, it being obvious that the cutter works in a horizontal plane on this machine, instead of a vertical, as in the types previously described. On this machine the roll on cutter is kept in contact with the work by means of the handle A, while handle B feeds the table containing the work under the cutter transversely.

That work for the profiler is not entirely confined to the milling of forms is amply illustrated by conditions as set forth in Fig. 9, where an arrangement for surfacing three bosses of different heights is shown.

To hold the work, two studs, A and B, are provided in a base, C, together with two clamps, D and E. The fixture is held to the machine by two bolts. Three hardened steel plates, F, G and H, are also set on this fixture, the purpose of these being to govern the position of the surface mill by means of a guide pin, which rests on these plates, while the vertical mill surfaces the three bosses.

Again referring to Fig. 12, the first follower shown at A is of the plain beveled pin type to fit the tapered hole of the spindle, or it is made with a straight shank to fit the guide pin hole as required.

The follower illustrated at B is used for surfaces to be milled on a slant, a type of which will be shown later. The third type C is for work with formed plate above work, as previously described, and consists of roll X, cutter Y, shank Z, spacing collar W, cutter drive-pin V, and cutter holding-screw Q. The roll in this case being free to revolve.

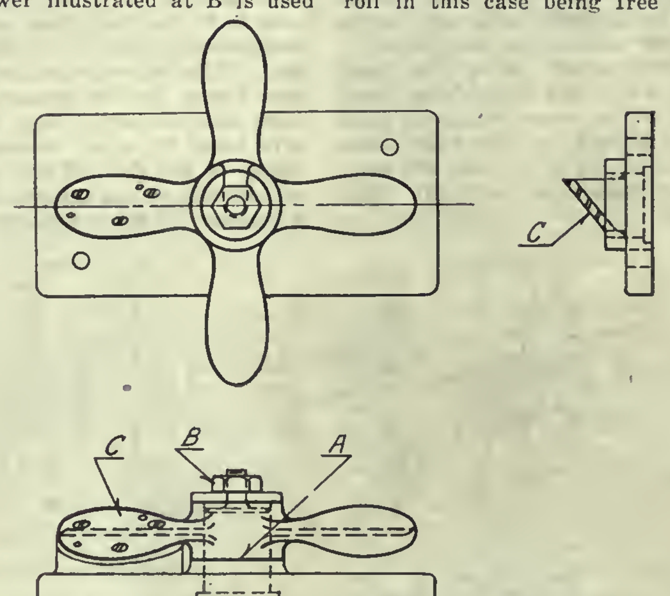


FIG. 10—FIXTURE FOR PROPELLOR BLADE.

At D, Fig. 12, we have shown a cutter R on shank S, which has a roll T mounted below the cutter, this cutter being driven by a collar U pinned to the shank, while a screw keeps the roll in place.

A type of work for which a roll beneath the cutter is adaptable is shown by Fig. 10, where a fixture for milling the outline of a propeller blade is shown, the propeller being held on a stud A by means of the nut and washer B, the under side of one blade, which has previously been finished, being pushed against a steel plate C while the work is being clamped. The outline of this plate conforms to the desired outline of the propeller blade, thus by keeping the roll in contact with this plate one blade outline is milled, while to mill other blades the propeller is turned, bringing each blade successively into position for machining.

Reference having been made in Fig. 12 to a guide pin B for milling angular surfaces, the illustration, Fig. 11, shows a condition of this kind. This fixture consists of a cast iron base A and means for holding a propeller securely, together with a formed plate B, whereby the desired shape is obtained by keeping the roll in contact with its upper surface. The propeller is mounted on a stud C and is held against formed plate D, while nut E and washer F clamp the same. In this position two adjustable slides G, having beveled ends, grip over the top of the blade in the manner shown, using screws H for adjusting purposes.

In operation a convex end milling cutter is mounted in the cutter spindle, while the convex end guide is mounted in the guide pin hole, therefore, by keeping the roll in contact with the top of guide block and transferring the propeller blade successively back and forth under the convex end milling cutter, a series of cuts are made approximating the back of the blade to the spiral convex form desired, which, by filing, can be made all that is desired. Each blade in turn is successively dealt with in the same manner until all are completed.

Many combinations along the same general lines are met in profiling practice, and it will be evident from the foregoing that cutters and formed plates are the chief items of expense, the holding fixtures themselves generally being quite simple.

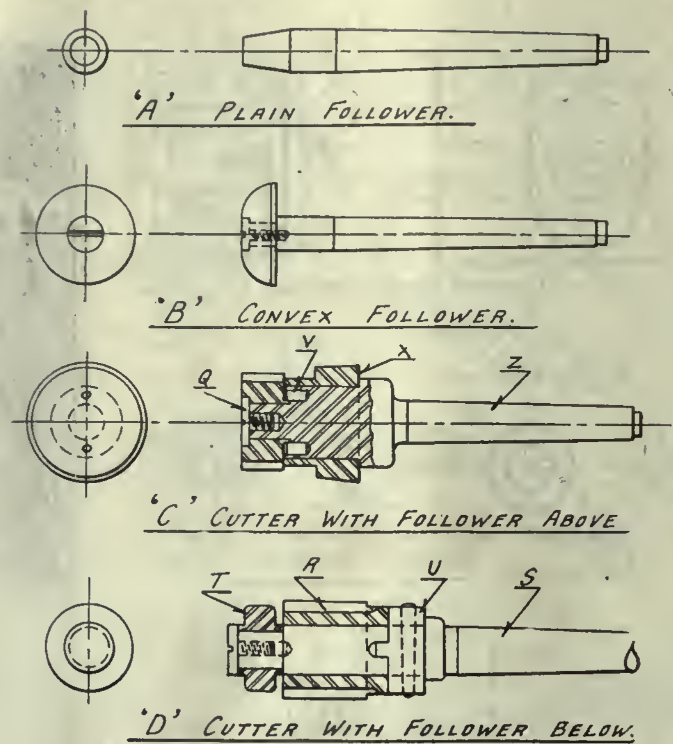


FIG. 12.—VARIOUS STYLE TOOLS USED.

BORING TAPERED HOLES

By W. ERNEST.

I do not presume that the following method of boring a tapered hole with the aid of the compound rest is new by any means, but judging from the way many machinists tackle such jobs it is certain that a great number of men are not aware of such an easy method. Most lathes nowadays have the "rest" graduated in degrees at the base, so that when a hole is to be bored, the number of degrees given it is a very easy method to proceed. In repair work, however, it is simply a case of making one part to fit another piece, or in many instances the taper per foot is given. One does not have to be very elaborate at figures to go ahead on these kind of jobs any more than if the actual number of degrees were given. As an instance, let us assume that we have a hole to bore, and have found the taper required to be 1½ inches to the foot. First of all get a pair of calipers and measure the diameter of the base of the compound rest. Suppose we have found this to be eight inches in diameter, it naturally follows that from the centre it swings on a four-inch radius. Now 1½ inches per foot is equal to ⅛ inch in 1-inch lengths, therefore, in 4 inches it will be four-eighths or one-half inch. However, seeing that the cutting action of the lathe takes off both sides of the hole as it travels around in a circle only half this amount of swing must be given the compound rest, or in other words, only ¼ of an inch. To do this set the dividers to a quarter of an inch off the scale and insert one point on the stationary line on the rest and swing around until the top zero mark comes exact on to the other point of the dividers and you will have the compound set so close to the desired position that it will cut the correct taper. This will eliminate any cutting and trying and continual knocking the rest about, to find the right location. Furthermore, all this can be done in quicker time than it takes to tell, and if the workman happens to be a regular lathe hand, once he has determined the foregoing facts he would hardly have to go over them again. All that would be necessary, if he already knows how much taper he wants, is to use his dividers or even a scale would do. Personally I have got very accurate results by judging the distance with my eye, from the graduations.

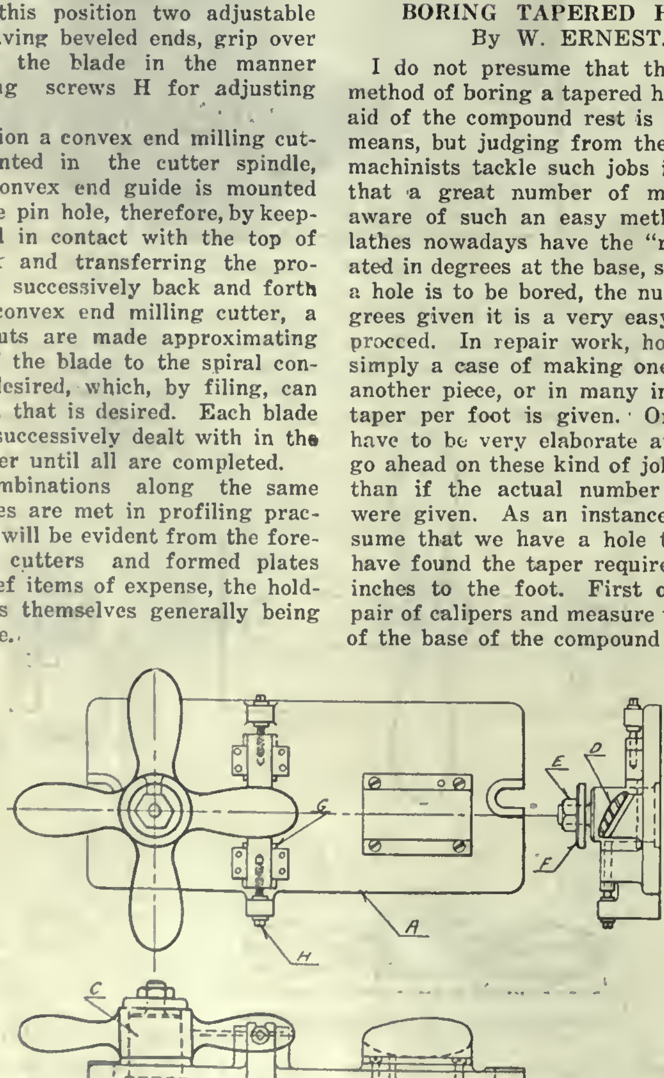
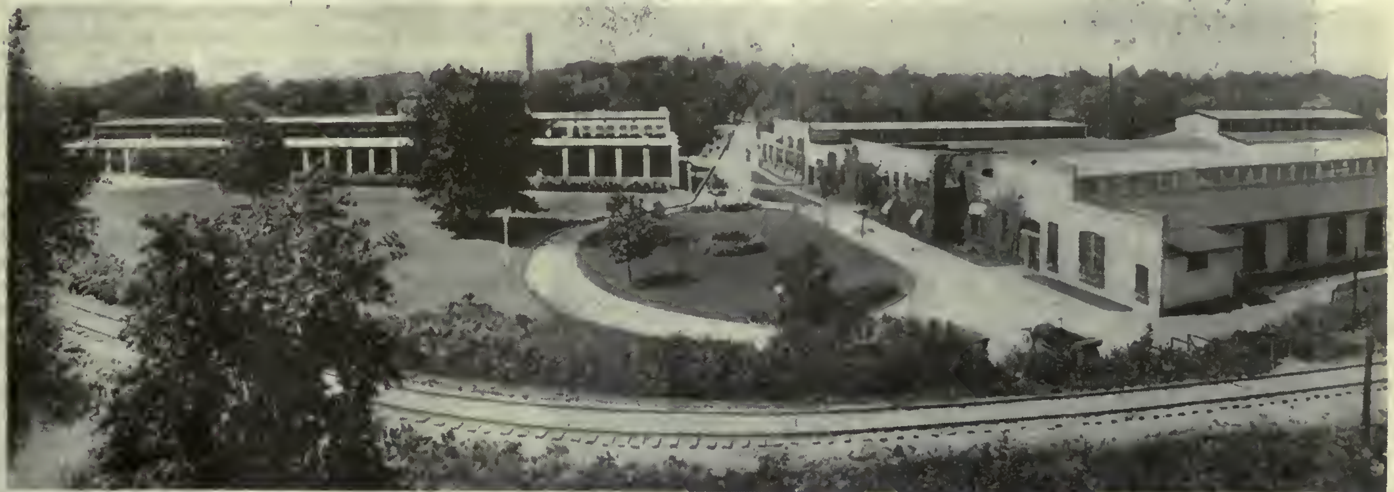


FIG. 11.—FIXTURE FOR MILLING ANGULAR SURFACES.

Buy Toronto Premises.—Chas. E. Goad Engineering Company has purchased the two-storey brick building at 205-207 Victoria Street, Toronto, and will use it as a warehouse. The building fronts 42 feet on Victoria and the sale price was about $65,000. The building is at present occupied by A. O. Gorrie & Company.

A *Manufacturing Plant* That Is Built in a Park



The Home of the Clark Equipment Company, of Buchanan, Michigan. Can Employees be Anything Else But Satisfied Working Amid Such Surroundings?

By J. H. MOORE

CAN you imagine yourself at work in a huge park with a profusion of trees and flowers surrounding you, yet be working in this park, not as a gardener, but as an employee in a manufacturing concern?

While such a condition sounds like a wild flight of the imagination, it is merely a brief way of stating the splendid plan adopted by the Clark Equipment Co., of Buchanan, Mich., for the benefit and welfare of their employees.

Believing that readers of CANADIAN MACHINERY will be interested in such a story of industrial progress, we have secured various views of the plant, together with the aims and purpose of this new and ideal method of working.

In starting to describe the relations existing at this plant, it is well to bear in mind the fact that all dealings are between the men, not between labor and capital. All plans are made and worked out on the assumption that each and every man is fair and trustworthy. Nobody is considered an eye worker, and every man is given a chance to prove his ability.

This policy has resulted in a cordial human relationship between the men and management.

Various projects have been started outside of the actual working conditions that are well worthy of mention.

Homes have been built, a theatre erected, a profit-sharing plan developed, a system of shop government established, giving the men a voice in the management, a community hospital has been established, and last but not least every encouragement has been given to each employee to join in athletic exercises. All these inducements make better satisfied workmen, which explains why the recent labor troubles never touched this concern.

The town of Buchanan, Mich., is not as large as New York City, having only some 4,000 of a population, but here people live, not merely exist. No doubt readers are already aware that the concern we speak of manufactures axles and steel wheels for motor trucks, also the well-known line of Celfor high-speed drills, etc., etc., so that it is hardly necessary to dwell on this point further, so we will proceed with a description of the plant itself.

The entire plant is laid out like a park, with the various buildings grouped around a centre garden, with well-kept lawns. The factory is approached through a long avenue of Lombardy poplars, and it is merely a minute's walk from the foundry or forge departments to lawns of velvet smoothness.

Each office has a pot of flowers, each window-ledge has its own flower-box, each lawn its flower-bed. The atmosphere and environment is such that one cannot help but feel that all is well with the world as far as this particular spot is concerned.

Tucked away in one corner of the plant is a complete greenhouse and conservatory, where all sorts of bulbs and plants are nursed until strong enough to be transplanted to the outdoor gardens.

The various departments of the plant are housed in buildings of most modern design; light and sunshine are everywhere. Blowers and suction fans sweep fresh air into every nook and cranny. Everything possible has been done to beautify the place, and sanitary conditions are considered above all else. The drinking fountains are of white enamel, and are of the fountain type.

Homes for Employees

A little over a year ago the company began building homes and selling them to employees at cost. This step was made only after the situation had been weighed carefully. Employees were given the benefit of long-time credit, and of course cheaper building costs owing to constructing in bulk.

Before going ahead with this housing venture the project was first submitted to the employees in the form of a questionnaire. When these forms were returned a meeting was held in the company's theatre, and, by the aid of talks, sketches, and lantern slides, the plan was explained. This gave the company a good idea of the number of houses necessary, how expensive they would be, etc., etc.

The company then purchased 110 acres of land and planted 40 acres to begin with. This plotted section was provided with all improvements, such as wide streets, trees, grass plots, sidewalks, water, gas, and electricity.

In order to head off speculators and keep profiteers from grabbing the unearned increment, the company, in fixing prices, added 100 per cent. to the actual cost of each lot, plus 5 per cent. on the cost of each house. The houses were sold to employees at prices ranging from $1,900 to $4,500, depending on their size and style.

The employee purchasing the home paid on terms arranged to suit his purse, so much down and so much in instalments, on an amortization plan that paid off both principal and interest, leaving the property free at the end of a certain period of years. The initial payments ran from $180 to $400, averaging about 10 per cent of the selling price.

After five years of payments had given the purchaser an equity sufficient to guarantee his good faith in carrying the deal through to the end, the 100 per cent. on the lot, and the 5 per cent. on the home were remitted and applied on his account. In this way the buyer got the house at actual cost price.

A very peculiar and interesting point was brought out when the company

THE APPROACH TO THE PLANT. WHO WOULDN'T LIKE TO WALK THROUGH SUCH A BEAUTIFUL AVENUE OF LOMBARDY POPLARS.

started to sell these houses, for it was found that the great demand was for the higher-priced homes instead of the smaller four-roomed bungalows. Not only did the employees wish for homes of good architectural lines, but they desired homes with plenty of room for expanding families.

The company was not slow to take the hint, so announced that any purchaser would be allowed to purchase his own lot, pick his own plan for his house, and the company would build it for him, providing it was not freakish in design. This plan proved a decided success, and many have taken advantage of the opportunity.

Some 44 houses have already been erected, and plans for additional homes are ready. It is only a question of shortage of material and labor which is holding the project up for the time being.

A Theatre of Their Own

Realizing that men who work must have healthy recreation, the company built a model theatre, with a seating capacity of a thousand people. At first a vaudeville troupe from Chicago was brought to amuse the Buchananites, and tickets were presented free gratis, but the American worker does not take kindly to anything smacking of paternalism, so that the actors played to mostly empty seats. This plan was abandoned and admission was charged the next time, with the result that the house was packed.

At the present time the employees have formed an organization called "The Clark Players," and this able cast presents such well-known comedies as "What Happened to Jones"; "A Pair of Sixes," etc., etc. The theatre is also used for minstrel shows, movies, and other entertainments of like nature.

The theatre is operated without profit, the admission fees paying for scenery and all expenses attached to the rehearsal and production of the plays by the home talent. The use of the hall is also given free for all company activities, or praiseworthy community purposes. The company also boasts of a gymnasium and plant orchestra.

AN INTERIOR VIEW OF THE CLARK THEATRE.

The Community Hospital

For the proper treatment of sick or injured employees the company has provided hospital facilities adequate in size and equipment for every emergency.

While this hospital was primarily intended for the use of employees only, the company, with a true feeling of team work, opened it to every citizen of Buchanan at cost. The institution is operated and conducted by the Clark Hospital Association, which is composed of employees and representative citizens of Buchanan. The township has shown its appreciation of their being included by making an appropriation of $2,000 a year ago to go toward the maintenance of the hospital.

The building itself is ideally located

HERE IS SHOWN ONE OF THE NUMEROUS FLOWER BEDS THAT BEAUTIFY THE PLANT.

between the plant and the employees' homes. It handles accident cases, treats the employees and their families in times of sickness, and cares for the maternity cases in the families of employees and community residents.

The hospital has an ordinary capacity of twelve beds, with provision for additional beds in case of unlooked-for demands, such as the influenza epidemic of last year. There are several rooms and wards, with a number of beds in each. The staff of nurses in attendance have commodious quarters, with all modern conveniences. The hospital has its own garden and poultry yard, and fruit is in abundance in the immediate vicinity. Ideal conditions you will admit.

Profit-Sharing Scheme

A little over two years ago the company inaugurated a plan of combined stock sale and profit sharing. The plan is as follows. Employees are allowed to subscribe for stock in an amount equal to 10 per cent. of their salary. This stock they purchase in lots, each lot consisting of one share of preferred and one of common.

No one can purchase more than four lots in any one year. With each lot is given an employees' participating certificate, which is entitled to a dividend of 6 per cent. each year, or higher if the directors so decide.

Of course the idea is obvious. If a workman holds stock it is figured that he deserves a larger dividend than the shareholder who merely invests his cash. The plan has worked out very successfully. Last year the shareholding employees received 7 per cent. dividend on their preferred stock and $12 on each participating certificate.

In addition to this there is at the end of each year a distribution of profits dependent upon the amount of the profits. The dividends to participating employees thus far has gone as high as 65 to 70 per cent. on their investment.

As readers can understand, the labor turnover has always been a big problem with any manufacturing concern, but the foregoing plans for their employees' benefit has brought this company good results in this respect. The firm computes their labor turnover by dividing the total number of employees leaving each month by the average number on the payroll for that month.

In 1917 the index figure was 118.50. In 1918 it was 118.6, making an average of 9.88 for each month in these two years mentioned. For the first half of 1919 the monthly figure was only 7.6, and of this figure 2.3 was desired by the company. This means that only 5.3 employees left each month of their own accord. In these troublesome times this is a record to be proud of, and one that speaks volumes for the spirit of contentment pervading the plant.

Another notable feature is that this plant is operated ten hours a day. The arrangement is approved of by both the employees and the management. This is only another proof that this entire organization is proving not only in theory but in practice, that honesty and justice are the true corner-stones of ideal working conditions.

Some cranks will tell you that there is no sense in catering to a workman's needs, that he doesn't appreciate it, and so on, but if you know of one of these wiseacres, let him read this article and convince him that it does pay to let your employees know that you have their interests at heart.

The Clark organization is like one big family, employer and employee working together hand in hand to attain ideal working conditions together with the aim to get the most out of life by putting the best ino it

SOME SPLENDID EXAMPLES OF THE HOMES ERECTED AT LIBERTY HEIGHTS FOR THE EMPLOYEES.

Modern Methods of Power Transmission

Getting the Maximum Power Out of Transmission Has Always Been a Study Well Worth While. This Article, Which Appeared in "Practical Engineer," Discusses Various Phases of Interest

By HARTLAND SEYMOUR

NOW that the conservation of fuel has become of such vital necessity in industry, it behooves every works engineer to investigate very thoroughly every loophole in his factory where waste is able to creep in. He will probably begin at that part of the works where his fuel is consumed, that is, the power-house. He will bring his power plant up to date, and will satisfy himself that he is obtaining the maximum possible percentage of power from the fuel he is consuming, and it is there he very likely stops. He does not seriously consider the waste of power that is going on in his shops, by the utilization of inefficient power transmission factors. For instance, unsuitable shafting, pulleys and belting. Yet the method of transmitting the power in the shop is no doubt an opportunity for considerable waste of power to occur. The problem really condenses to this: To deliver to the machinery to be driven the maximum possible amount of power received in the shop.

When laying out a new shop the engineer can often effect a considerable saving in his power plant by the judicious arrangement of his machines. One method employed by the author was to have a large scale plan of the shop made, then to cut cardboard figures of the machines to scale, and after this to arrange and rearrange these cardboard shapes on the shop plan until the most efficient disposition has been arrived at. Heavy machinery should always, where possible, be arranged near the main drive, so as to economize in the length of heavy shafting to be carried in the shop. Again, if there are any machines which do not run continuously, these should be grouped together, as continual stopping and restarting involves considerable wear and tear on the belting. There are other considerations, of course, such as an arrangement whereby the constant moving forward of the work in hand is assured.

In many shops the capital sunk in the transmission of power has apparently been of no consequence, for the machines have been arranged in straight lines, it is true, but with the very evident lack of forethought. A machine has been installed in a certain position, the shafting carried to it, and the power finally delivered, but the responsible authority evidently has not considered the fact that every bearing is a source of loss, besides the extra cost in initial outlay as well as the maintenance cost, which is usually very heavy.

Having arranged his machinery and planned the lay-out of his shafting, the engineer must next consider the erection of that shafting. It is extremely important that the shafting be well aligned. This is, naturally, something of a problem where the machinery is heavy and the floors subject to loads which are being continually shifted. The method of levelling from section to section of the shafting by a spirit level is extremely unsafe, as a very minute error in each bay will amount to something considerable at the end. The other method of aligning the shaft sideways with a tightly-stretched wire, parallel with the shafting, is fairly satisfactory, but is inconvenient when the shafting varies in diameter in different sections. One very successful method employed in some shops in America is to utilize a surveyor's level.

The level is supported on two wooden horses beneath one end of the shaft. The instrument is properly set by means of dropping a plumb bob from the shaft to the instrument, and then from the instrument to the floor, on to a mark. An adjustable target is hung from the shaft in front of the level, the cross-hairs being adjusted to coincide with those of the instrument. The target is provided with a set of jaws which engage the shaft and adjust themselves to any diameter, without altering the position of the cross-hairs. A fixed target is hung from the opposite wall on the sight line of the level, then the movable target is shifted from section to section of the shafting until the job is completed. This is a somewhat elaborate method, but is, nevertheless, highly effective.

The main drive should always be placed at the middle of the shaft if possible,

TABLE I.

Shaft diameter in inches.	Shaft revolutions per minute.										
	50	100	120	140	160	180	200	250	300	350	400
	Horse-power transmitted by shaft.										
1	1.0	2.0	2.25	2.75	3.0	3.35	3.75	4.9	5.8	6.75	7.60
1¼	1.95	3.75	4.45	5.25	6.0	6.75	7.50	9.25	11.25	13.0	15.0
1½	3.25	6.50	7.65	9.0	10.25	11.56	12.85	16.0	19.35	22.5	25.9
1¾	5.0	10.25	12.30	14.25	16.50	18.50	20.50	25.65	30.75	35.80	41.0
2	7.55	15.25	18.30	21.40	24.45	27.5	30.58	38.25	46.0	53.5	61.25
2¼	11.0	21.75	26.0	30.50	34.75	39.0	43.50	54.35	65.30	76.20	87.0
2½	14.85	30.0	35.75	41.75	47.75	53.75	59.65	74.58	89.55	104.80	120.0
2¾	20.0	39.75	47.75	55.60	63.60	71.50	70.50	99.50	120.0	140.0	160.0
3	25.85	51.55	62.0	72.25	82.50	93.0	102.80	130.0	155.0	181.0	205.0
3¼	32.75	65.60	78.70	92.0	104.80	119.10	130.90	165.0	196.0	230.0	263.0
3½	41.10	82.0	98.25	115.0	131.10	147.75	163.80	205.0	246.0	286.0	329.0
3¾	50.45	101.0	120.80	140.90	161.0	180.0	203.0	252.0	301.0	353.0	402.0
4	61.20	122.0	147.0	171.0	196.0	220.0	245.0	305.0	367.0	429.0	490.0
4¼	73.40	147.0	175.80	205.0	235.0	264.0	292.0	367.0	440.0	515.0	586.0
4½	87.25	174.0	210.0	245.0	280.0	312.0	349.0	435.0	522.0	610.0	696.0
4¾	102.10	205.0	246.0	286.80	328.0	370.0	410.0	512.0	615.0	716.0	820.0
5	120.0	240.0	286.70	335.0	382.0	430.0	478.0	596.0	716.0	835.0	955.0
5¼	138.20	275.60	332.0	387.0	443.0	497.0	553.0	690.0	830.0	968.0	1106
5½	160.0	318.20	382.0	445.0	510.0	572.0	635.0	795.0	954.0	1112	1272
5¾	182.05	362.70	436.0	510.0	581.0	654.0	727.0	909.0	1090	1272	1455
6	205.0	413.0	495.0	578.0	661.0	743.0	825.0	1032	1240	1445	1650
6½	261.80	525.0	630.0	736.0	840.0	945.0	1050	1312	1575	1835	2100
7	327.90	656.0	787.0	918.0	1050	1180	1310	1640	1965	2295	2625
7½	402.0	806.0	968.0	1130	1290	1450	1615	2015	2420	2825	3225
8	490.0	980.0	1175	1370	1565	1760	1958	2445	2935	3425	3915
8½	588.0	1174	1410	1645	188	2115	2348	2935	3520	4110	4659
9	696.0	1395	1673	1950	2230	2510	2785	3485	4180	4875	5575
9½	820.0	1640	1967	2295	2620	2950	3278	4097	4918	5735	6555
10	956.0	1910	2295	2675	3060	3441	3825	4780	5735	6690	7645

TABLE SHOWING SHAFT DIAMETER AND HORSE POWER TRANSMITTED BY THESE SHAFTS UNDER CERTAIN CONDITIONS.

and on the same level as the shafting. If the drive is at one end of a shaft from which, say, twenty machines are driven, it is obvious that that shafting must be of sufficient diameter to convey the necessary horsepower to twenty machines, whereas if the drive is at the middle the shaft need only be large enough to transmit the horsepower required for ten machines on either side.

The question of the diameter of a line shafting is one of the most important in the whole transmission system. It should only be large enough to transmit exactly what is required of it. It is safe to run a shaft slightly larger, but the margin should be extremely small from the efficiency point of view. In this connection it is always well to remember that a small diameter shafting can be made up for by running it at a higher speed. Although the speed, or revolutions per minute, varies widely with the type of machine to be driven, it is usual to run a line shafting at anything up to 400 revolutions per minute.

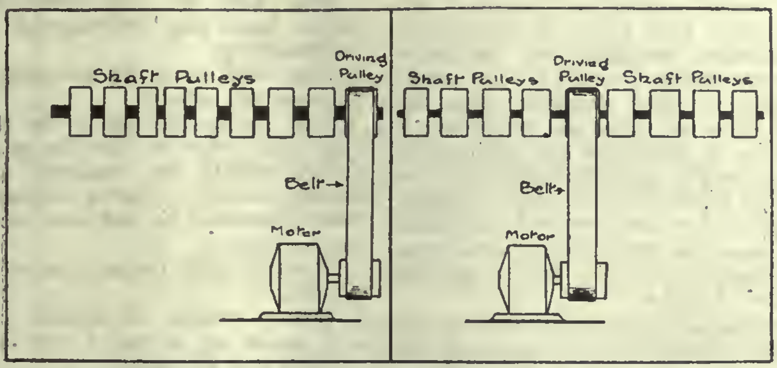
It is obvious that a large diameter shaft, while being capable of transmitting more power than the smaller shaft, requires more power to turn it, and this is a very common source of power loss in many works. In fact, in some works visited by the author, the shafting would with ease operate twice the number of machines required of it.

Table 1, on the opposite page, gives an idea of the horsepower transmitted by good steel shafting.

There are other considerations to be taken into account when the diameter of the shafting is being settled. One of the chief of these is the distance between bearing centres. The line shaft which receives the main drive must be supported by suitable bearings on either side, and the whole section must be absolutely rigid. The location of the other bearings will very often depend on the type of workshop construction, but it is obvious that the further apart the bearings are, the greater will the diameter of the shafting need to be.

There are many considerations to be taken into account when placing the bearings, such as the size of the shaft, the number of pulleys and the speed of the shaft. Naturally, in the latter case, if the speed is high the bearings will need to be closer together than when the shaft is turning comparatively slowly. Of the shaft. Then, the shafting at the motor end must be of sufficient diameter to transmit the horsepower required for eight machines, but beyond that machine the shafting may be turned down to a diameter sufficient to carry the horsepower required to seven machines, and so on, until the last machine is reached, when the shaft need only be large enough to convey the horsepower required to drive the one machine.

When the type of shafting has been decided on, the next factor should be the means of coupling the various lengths of shafting. There are many types of



LAYOUT SHOWING PULLEY, BELT, AND MOTOR ARRANGEMENTS.

course, from the point of view of economy, every available inch of shafting should be utilized.

It is possible to effect economies in many ways in line shafting. For instance, supposing eight machines are driven by a motor placed at one end of coupling on the market, each with its own specific qualities. It is not intended to describe these at any length, but to give a few remarks on the use of these types as a whole.

The first point to remember is to see that there are no projecting parts in a coupling, such as bolt heads, nuts, etc., as these projections are a source of considerable danger. To avoid this the coupling can be shrouded or protected in some way. To avoid undue strain on the shaft, a coupling should always be placed as near a bearing as possible and away from the source of power. Further, when coupling two shafts of different diameters, it is economical to turn the larger shaft down to the size of the smaller shaft, and secure a coupling to fit the latter.

An enormous loss of power in the transmission system is the bearing friction. There are, however, many types of bearing procurable, and with a little careful selection this loss of power may be reduced to a minimum.

The ordinary interchangeable swivel bearing is usually made of cast iron and lubricated with oil or grease; the latter is usually yarn grease or calypsol. These bearings are, if required, fitted with glass oil gauges. Another type of swivel bearing is fitted with hardened steel ball bearings. This type of bearing is extremely serviceable where light loads are carried, and require very little attention beyond the lubrication, which is usually vaseline. The load is always carried on three balls, and the bearing is not liable to be ruined by sudden distortion or lowering of one end of the shaft.

When the motive power is supplied by a motor, one of the best bearings for this purpose is fitted with hardened steel rollers. It is said of this bearing that the starting resistance offered to the motor is very little more than the running resistance. This is obviously a great advantage, for instead of the motor having to be of sufficient capacity to overcome the starting resistance, it need only be powerful enough to drive the installation.

Having decided on the type of shafting, coupling and bearing to be employed, the next point is the means of suspending the shafting, namely, by brackets for walls, hangers for ceilings, and pedestals for floors.

Hangers are made closed or open sided. They provide for automatic aligning of the bearing with the shafting, and also permit of the bearing being adjusted horizontally or vertically.

Swivel pedestals are made both adjustable and non-adjustable. That means that in the former case the bearing can be adjusted either vertically and horizontally to the extent of ½ in. or so. The non-adjustable type does not permit of vertical or horizontal motion, but is provided with a swivelling movement, which ensures automatic alignment with the shafting.

For heavy work or first motion shafts, girdle type, rigid pedestals are usually employed. These pedestals are made with an angular or horizontal joint and lined with gunmetal, phosphor bronze and babbitt metal.

Pedestals and bearings can, of course, be obtained in one unit, either swivelling or non-swivelling. In erection of the latter type great care must be taken to see that the shaft is true.

It will thus be evident that there is a very wide range of choice of shafting and its fittings, and also an opportunity for the works engineer to get exactly what he wants. There is no reason why, if efficient transmission factors are obtained and regularly inspected, any works should suffer from loss of time due to a breakdown which might otherwise have been avoided.

A soldering iron, with an electric arc inside of it for the heating element is being used for some kinds of repair work in Europe. The rear surface of the copper head forms one arc electrode, the other being a carbon rod adjusted by hand. Except for a small gas opening, the arc is entirely inclosed and insulated with porcelain. It takes three minutes from the time the arc is struck to heat the copper to the right temperaure for soldering. With a small resistance in circuit for steadying the arc, the implement uses 625 watts at 125 volts. The arc itself operates at 40 volts, the remainder being consumed in the resistance.

Standard Spindle Noses for Milling Machines*

THE activities of the British Engineering Standards Association with regard to the standardization of milling cutters and small tools will be of great benefit both to users and makers, and it is anticipated that the new standards when finally decided upon will be widely adopted.

It has not hitherto been found possible to adopt the standardization of spindle noses of milling machines, mainly on account of the fact that there are so many machines of American manufacture in use in this country, and it is hardly to be hoped that the British Engineering Standards Association will be succesful in persuading American and British manufacturers to agree to one standard for both countries.

It appears, therefore, that the only course which is practicable in this country is the adoption of a standard spindle nose for British milling machines.

The design of spindle noses has changed considerably in recent years as a result of the heavier duty which has latterly been performed by milling machines, which has shown up the weaknesses of spindle noses as formerly, and even now, largely made.

It is generally agreed that some form of clutch drive is necessary on a spindle nose for heavy milling, and experience has proved that the clutch should be of the closed and box type with a view of avoiding distortion in use.

It has also been found necessary for heavy work to harden the clutch with the same object, viz., to prevent distortion.

Screwed spindle noses have been found to be faulty for heavy work, as even when made with multiple threads it frequently becomes impossible to remove cutters which are screwed upon them, and the tendency has therefore been on new designs to adopt either parallel or taper fits, holding the cutter back by a draw bolt through the spindle, the torsion being taken by the clutch drive.

The taper nose has advantages over the parallel nose in that the cutters are more easily applied and removed and more easily kept true. As makers of heavy milling machines these considerations were borne in upon us as a result of troubles which occurred with the earlier types of noses, and we believe it might be of benefit to the engineering trade generally to publish particulars of the noses which we have finally adopted, and which have been proved by considerable use during the last nine years to be satisfactory and to be free from any practical objection.

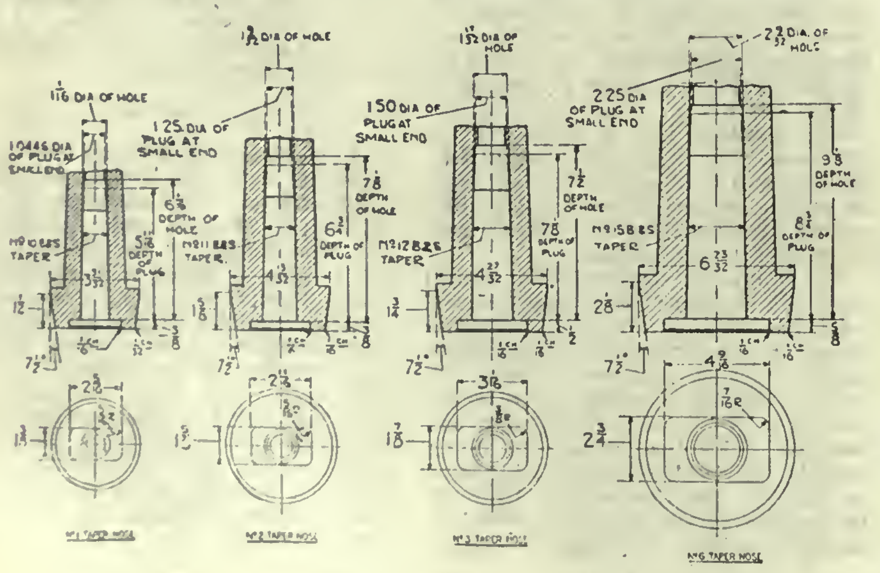
The illustration shows the four standard noses which we have adopted, the external taper being made to a uniform angle of 7½ deg. with the axis, or in other words, an included angle of 15 deg.

Brown and Sharpe tapers have been adopted for the arbors, as these are in almost universal use; the clutch drives are milled out from the solid as indicated. The ends of the spindle noses are hardened so that the hardening applies both to the external taper and the clutch, and both internal and external tapers are finished by grinding.

There are no keys or other parts in this spindle nose which can come loose, and the design enables face cutters to be used very close up to the bearing of the spindle.

We suggest that the particulars which are now offered for publication for the first time may be of assistance to other designers of milling machines and may lead to the adoption of a satisfactory British standard for spindle noses.

*From "Machine Tool Review."



SECTIONAL VIEW OF VARIOUS SIZE SPINDLE NOSES.

GRINDING WHEELS

When grinding wheels are received in good condition, carefully handled and properly installed and operated, they are reasonably safe. To make sure that wheels are reasonably safe, see:

That they are sound and free from cracks or flaws.

That they are not operated at a higher speed than recommended by the manufacturer.

That they do not fit too tight or too loose on the spindle.

That the flanges clamp the wheel at the outer edge of the flange. (The flanges should be "relieved" in the centre, leaving a bearing surface about three-fourths of an inch wide around the outer edge).

That the inside flange is secured to the spindle.

That a washer of blotting or other soft paper is installed between the flanges and the wheel.

That the diameters of the flanges are the same and between one-third and one-half the diameter of the wheel.

That the wheel runs true and in balance.

That the spindle-bearings are neither loose nor so tight as to cause heating.

That oil does not work out on the wheel.

That the nut tightens in the direction in which the wheel revolves.

That the wheel is protected with a guard which would retain it should it burst.

That the arbor-ends and nuts are guarded.

That the belt is guarded at the pulley-contact.

That the tool-rest is securely adjusted close to the wheel surface.

When first starting a grinding wheel stand to one side for about half a minute as this is the time when wheels are most likely to burst.

Wear goggles when grinding.—"National Safety Bulletin."

Many of the Aleutian Islands, which stretch westward from Alaska Peninsula towards Asia, bear deposits of sulphur of the type called solfataras. Sulphur claims have been located at three places on these islands and on the peninsula, one of them in the crater of Makuhin Volcano, on Unalaska Island. The sulphur deposit is the only part of the crater that is permanently free from snow and ice, being kept so by subterranean heat and by the discharge of hot sulphurous vapor. In this crater 10,000 to 15,000 tons of sulphur may be available for mining. Another deposit of sulphur is on Akun Island. It covers 15 or 20 acres, and contains about 1,200 tons to the acre. Still another is on Stepovak Bay, on the south shore of Alaska Peninsula.

A *Personal* Chat With Our Drawing Course Students

A FEW days ago we received a letter from one of our students, who was a recent prize winner. He stated that at the time of writing his prize had not yet come to hand. We were greatly surprised to receive this letter as our instructions are that prizes be sent immediately winners are announced. We forwarded another scale immediately, which no doubt has been received by now.

Should there be other students who likewise did not receive their prizes, we would appreciate their writing us at once.

We would like to put a direct question to our students—"Why are we not receiving more plates to decide upon?" We know that over 500 students are following this series, therefore it is only natural that we look for a steady stream of drawings.

Lately the number of plates received has dwindled. **What is the reason? Are our plates too difficult or intricate? Are the instructions not sufficiently clear? Are we traveling too fast, or is our series ceasing to interest?**

We would like readers to realize that this course is being run for their benefit and that additional information and help will be furnished at any time upon request.

We have watched with interest the progress of some of our students and it has been very encouraging. A steady improvement has been noted from the beginning and we are pleased to say it is continuing.

Having stated *our* views on this matter, we expect to hear *readers'* opinions, so request that every student following the course (even if he has never sent in any of his work) write us fully as to his opinion of it. Let us know your candid opinion, be it favorable or otherwise.

Above all, write us without delay. If this course is not interesting our readers we want to know, so that we may, if necessary, discontinue it. Should you wish it continued and to perform your work on it quietly at home, say so frankly.

We look for a steady inflow of letters on this subject and in order to make it interesting we will offer three prizes to the best letters received.

By best letters we mean the letters which discuss the course in such a way as to furnish us with satisfactory replies to the above questions. Let us hear from you—Now.

WELDING AND CUTTING

Electric-Arc Welding Equipment*

By H. L. UNLAND†

PRACTICALLY all arc welding is accomplished by either the metallic or the carbon electrode method. In the metallic-electrode method the electrode consists of a wire or rod held in a suitable holder. The heat of the arc, in addition to melting a small pool on the work, melts the electrode and the current causes the molten metal to be driven in finely-divided particles against the work. By this method metal can be deposited on vertical surfaces, and it is the only way in which metal can be successfully deposited overhead. The metal deposited by this method is more uniform and a weld so made is stronger and has a smoother and more regular appearance than one made by the carbon electrode. For these reasons the metallic electrode is used when strength or appearance is important.

The carbon-electrode method is used for building-up metal, plugging holes in castings, welding, or for joining parts where strength and appearance are not essential, or where the surface is to be machined off. Since heavy currents can be used, metal can be deposited rapidly. In the carbon-electrode method a carbon rod is used instead of the metal electrode. The arc fuses the metal of the work and additional metal is supplied by melting a rod of filling material in a manner similar to soldering with an iron or welding with a gas torch.

Welds that are soft enough to be machined can be made by either method if reasonable care is taken. The deposited metal should not be chilled, and if the carbon electrode is used the arc should be kept long enough to prevent carbon being carried into the weld. Besides the above causes, the principal reasons for hard welds are poor quality of electrode metal or filling metal.

The deposited metal is obviously cast steel, since it is merely fused in place and is not ordinarily subjected to any mechanical working afterward. The metal will have the coarse-crystal structure found in unannealed cast steel and likewise will have comparatively low values for reduction in area and elongation. In some cases the tensile strength of the metal in the weld may be as high as 55,000 to 60,000 lb. A safe figure is 35,000 lb., provided the work is done by experienced welders.

The following table shows the approximate kilowatt-input required for various systems:

	Kw. or Kva.
Alternating-current 100-volt supply	15
75-volt constant potential	15
60-volt constant potential	12
Alternating-current 110-volt supply	7
40-volt constant potential	8
Constant-energy equipment with supply motor-generator set	7.65
Constant-energy equipment operating from 125-volt line	5.35

If a considerable number of operators be employed, the outfit requiring low input is much to be desired, as the cost of operation is reduced.

There are several principal types of welding equipment, among which are:

1. Constant-energy self-excited generator.
2. Constant-energy balancer sets.
3. Constant-potential generator with auxiliary equipment.
4. Alternating-current welder.

All except the constant-potential type are primarily single-operator individual outfits suitable for bare metallic-electrode welding only. The constant-potential type may be used as single-operator equipment for either carbon or metallic-electrode welding or a number of operators may work from one machine. This type of machine also permits the use of the carbon electrode for cutting.

The equipment for each type of apparatus is as follows:

The constant-energy self-excited generator is arranged for belt drive, or to be directly connected to a direct-current motor or to a 60-cycle 3-phase alternating-current motor. This type may also be direct-connected to 25 or 50-cycle alternating current motors or to alternating current motors of any of these frequencies wound for two-phase circuits, the maximum voltage being 550 It can also be direct-connected to gasoline engines or to other engines with speeds of either 1,200 or 1,500 revolutions per minute.

The constant energy balancer sets are suitable only when 110 to 125-volt direct current is available. If the circuit has the positive side grounded it is entirely satisfactory, if not, special precautions must be taken.

The constant potential generators can be direct connected to direct-current motors or to a 60-cycle, 3-phase alternating current motor. The equipment is also suitable for connection to gas, oil or steam engines.

Alternating current welders may be used on 60-cycle circuits of 220, 440, or 550 volts. The welder is single-phase, but where several are in use on a polyphase system they may be distributed among the phases to balance the load in part.

The constant energy arc-welding generators of the self-excited type are designed to obtain in one machine all the characteristics demanded by arc-welding service. This is obtained without the use of external ballast-resistance or separate excitation from any external source. Since the machine provides its own excitation, the voltage characteristics are such that throughout the proper working range of the arc the energy delivered is practically constant. The voltage and current follow the momentary variation in the arc condition practically instantaneously, and consequently the lag between change in arc conditions and resulting corrective change in electrical conditions is reduced to a minimum. This lag is one cause of trouble in welding with self-regulating welding equipments whether the automatic feature is embodied in the revolving apparatus or is mounted on the control panel.

How Generator is Wound

The generator is so wound as to give a no load or striking voltage of 60, which, when the arc is struck, automatically decreases to the voltage required by the arc. This is from 18 to 20 volts for the average operator and average good work. A longer arc is undesirable. Skilled operators on smooth work are sometimes able to hold a short arc with a voltage as low as 16, but in rating the generator 20 volts is used. By adjustment of the dial-switch on the panel the current may be adjusted from a maximum of 200 to a minimum of 75 in 25-ampere steps.

The constant energy arc welding sets of the balancer type is a novel type of arc welding equipment which combines the best electrical characteristics for the arc with high efficiency and light weight. It operates from a 125-volt direct current supply-circuit, but will also operate on voltages as low as 110. A supply voltage of 125 was selected because that was found to give the best results, not only from the standpoint of efficiency, size and weight for the set, but from the standpoint of the distributing system. These characteristics have been demonstrated both from a series of practical

*From "Metal Trades."

†Power and Mining Engineer, General Electric Co.

tests under commercial operating conditions and from oscillograph curves.

The balancer set is of standard two-bearing construction, built for operation on 110 to 125-volt direct current supply circuits. The two armatures are mounted on one shaft and connected in series across the 125-volt supply circuit. One terminal of the welding circuit is taken from the connection between the two armatures and the other from the positive line. By this means each of the machines supplies part of the welding current and, consequently the size and weight of the machines is minimized. The design of the fields and their connections is such that the set delivers the voltage required directly to the arc without the use of resistors or other energy-consuming devices.

The current control gives six steps of the approximate values 50, 70, 90, 110, 130 and 150 amperes. If intermediate current values are required they can be obtained by means of the generator field-rheostat.

Arc welding is usually done on metal that is grounded, and this is unavoidable in ship work where the ship structure is always well grounded. Since successful operation requires that the positive terminal be connected to the work the supply circuit should be arranged so that it can be grounded on the positive side with entire safety.

In the constant potential arc welding generators any direct current can be used for welding, but the voltage must be reduced to values from 20 to 50 volts. One method of obtaining this condition is by using a constant potential supply circuit and inserting resistance in series with the arc to absorb the excess voltage. This is an inefficient method of operation with the ordinary supply circuits as the voltage absorbed by the rheostats is a large part of the total energy. If the supply circuit is 550 volts and the metallic arc is being used at 20 volts, the energy used is only a small fraction of that taken from the line. In order to avoid these losses the General Electric Co. has developed a line of special low-voltage generators and a method of control. The generator is wound for 60 to 75 volts, which is as high as is ever required for welding.

The automatic control equipment gives protection to the generator without affecting other operators, whose welding circuits may be connected to the same generator. The setting of the dial switch on the welding panel determines the amount of resistance in series with the arc, and, therefore, controls the current used. This is regulated as required by the work to be done. Before starting the arc the operator sets the dial switch for the amount of current required for the work so that on starting the circuits are in normal running position. Thus it is not necessary to have any relays or switches open or close, or to change or disturb the electrical circuit in order to weld.

Alternating current arc welding equipment has been developed. A single-phase transformer is used and is provided with taps and connections for obtaining the various values of current and proper voltage required by the bare metallic electrode arc as used in welding. The equipment operates on a 60-cycle circuit and with supply voltages of 550 or less.

It is difficult to give universally applicable figures covering amperes, speed, etc., for electric arc welding because of the effect of the conditions under which the work is done, the character of the work, and, to a large extent, the skill of the operator.

Approximate speeds of welding sheet metal with the metallic electrode are given in the following table:

Thickness of plate, in.	Speed, feet per hour	Cost per foot, cents	Comparative cost per ft. acetylene welding cents
1/16	20	2.12	1.78
1/8	16	3.12	4.66
1/4	10	7.13	13.1
8/8	6.5	12.3	36.1
1/2	4.3	19.8	Much higher
3/4	2.0	41.7	Much higher
1	1.4	61.3	Much higher

The above are based on average figures for materials and labor. They will probably vary considerably for different localities and will vary slightly with the type of equipment, but the relative costs of gas and electric welding will in general hold true.

The carbon electrode can be used frequently for welding and for building up metal where the metal is not subjected to high strains or where it is under compression only. It can be used also for rough cutting of plates and structures.

The following figures for metallic-electrode welding are based on favorable working conditions and a skilled operator. However, they are approximations only and are given merely as a general guide.

	Amperes
Light work	25 to 125
Heavy work	up to 225

Electrode-diameter, inches	Amperes	Corresponding plate-thickness, inches
1-16	25- 60	Up to 3-16
3-32	60- 90	Up to ¼
⅛	80-150	⅛ to ⅜
6 32	125-200	¼ up
3-16	175-225	⅜-up

The same size of electrode may be used with various thicknesses of plate. The heavier plate will require the use of the heavier currents.

The average current ranges for different types of work are as follows:

	Amperes
Light welding	150 to 250
Medium welding	250 to 350
Heavy welding and medium cutting	400 to 600
Very heavy welding and heavy cutting	600 to 1000

The maximum values of current permissible for carbon electrodes are as follows:

Diameter of electrode	Maximum amperes
¼ in.	100
½ in.	300
¾ in.	500
1 in.	1000

Graphite electrodes permit the use of somewhat higher current densities but the higher cost of graphite electrodes is a serious handicap to their use. Lower currents than the above may be used but higher values will cause undue burning of the electrode.

For depositing or building up metal by means of the carbon arc on flat surfaces where the work is accessible and all conditions favorable, the following figures apply:

Current, amperes	Pounds per hour	Cubic inches per hour
200	1½	5.4
300	3	10.8
400	4½	16.2
500	6	21.6

For continuous work the above figures apply, but, for short jobs of ten minutes or less the rate will be double the above.

Welding wrought iron and steel in simple sections by the electric-arc welding process presents no serious difficulties. Reasonable care on the part of the operator in keeping the weld clean and in the preparation of the weld will, with ordinary skill in welding, produce a successful weld. The subject of welding may be divided into three parts, namely, equipment and materials, preparation of weld and welding.

Other Equipment

In addition to the regular equipment and auxiliary apparatus, special jobs make it desirable to have on hand other miscellaneous pieces of equipment. Odd pieces of carbon-block or of copper may be used as dams in holding the molten metal in place. If the weld must be smooth on one side a piece of copper or carbon may be held against the weld and metal filled against it. Iron or steel can be used if care is taken not to weld to it. When a hole is being filled the bottom may be closed by holding a plate of carbon or copper against it until sufficient metal is filled-in to hold. Care should be taken to flow the molten metal against the guide-pieces and not to allow the arc to play directly on them, otherwise the weld will probably be contaminated by this material, or else the guide-piece may be welded solid and cannot be easily removed.

A steel wire scratch-brush is useful for removing light scale and rust if necessary, before commencing to weld, and also at intervals during the welding, usually when changing electrodes.

(To be continued)

A recent application of the oxy-hydrogen flame is to the spraying of metals on to cold surfaces. In what is known as the Schoop process the metal, in the form of wire, is fed into the interior of the flame, where it is melted and then blown by compressed air, in a state of very fine division, on to the surface to be coated. The arrangement is such that when the size of the flame is increased or decreased, the feed of wire is changed simultaneously, so that the rate of deposit per unit area is constant. The finely-divided metal fills all the interstices of the surface upon which it impinges, and becomes firmly attached, and by continuing the process any desired thickness may be deposited. By this method surfaces may be coated with metals of high melting points such as nickel, and the working costs are low.

DEVELOPMENTS IN SHOP EQUIPMENT

TWO-SPINDLE SPLINE MILLING MACHINE

THE two-spindle spline milling machine herewith described and illustrated, has been recently placed on the market by The Taylor & Fenn Co., Hartford, Conn.

This machine is automatic in operation and is designed to simultaneously machine two spline grooves up to six inches in length on opposite sides of the same piece, single splines of the same or different diameters simultaneously on two pieces, or through slots such as drift pin slots or cutter slots in boring bars and similar work. Rapidity of action, ease of manipulation, facility of adjustment and large capacity permit this machine to handle a wide range of machine parts. Once set to cut a certain depth and length of slot it will continue to do so until readjusted.

Two cutters operating simultaneously reduce the machining time by half on work where two spline grooves are cut simultaneously in the same piece or in two separate pieces.

Work of any diameter up to 5 inches and of any length may be splined. A V-shaped vise affords a positive clamp for the work beyond the cutter traverse at one end, while the other end of short work, if centred, is supported on a male centre, and if uncentred, is supported in a female cone. Long work is free to project beyond the confines of the machine both front and back.

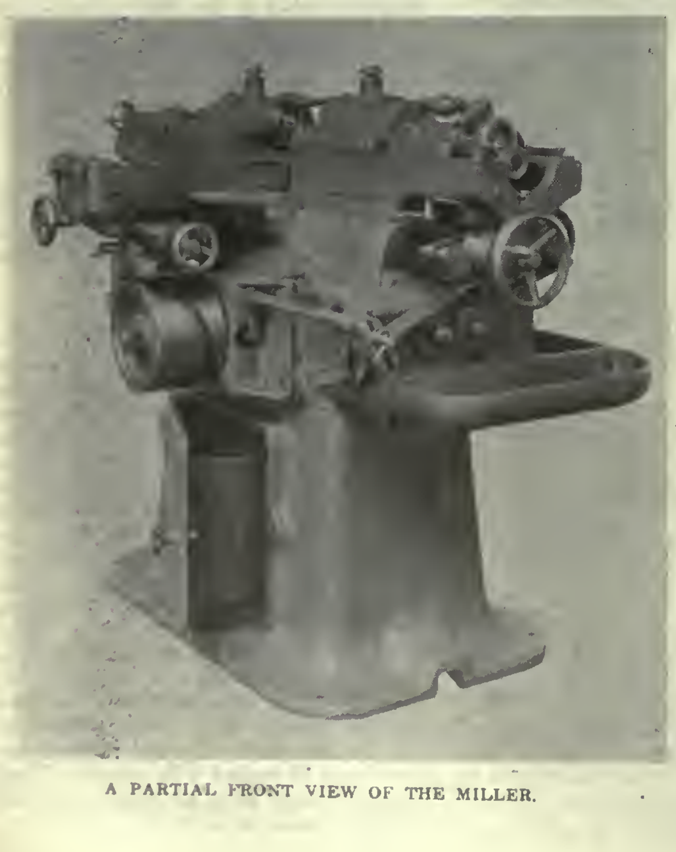
The maximum table travel is 6 inches, therefore the maximum length of spline which may be cut at a single setting is six inches plus the diameter of the cutter. There are six changes of spindle speeds ranging from 302 to 1,885 r.p.m., and ten changes of table feed, so that ample range is provided for handling splining operations in various metals.

Efficiency in this type of machine is dependent on the efficient operation and co-ordination of three functions. The cutters must rotate at correct speeds; the traverses of the table between extremes must be accurate and at correct speeds and the feeding of the cutters to depth must be properly timed and in uniform increments. All these essentials have been incorporated with the result that splines of exact duplicate lengths and uniform high finish and accuracy are produced in a minimum period of time, the duration of which of course depends on the length, width, and depth of the spline and the cutting resistance of the metal being worked.

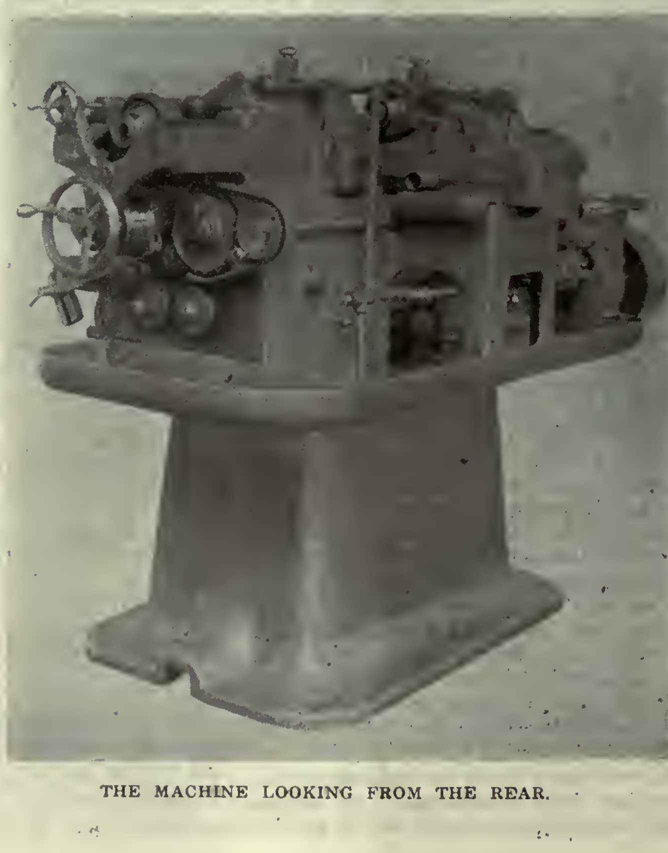
No countershaft is necessary as to the drive is direct from a pulley on the line shaft to a tight and loose pulley to the left at the rear of the machine. The shifter rod extends through to the front of the machine where all other controls are located.

A speed box, within the column and to the left affords six gradations of spindle speeds. The controls for the speeds are within easy reach of the operator when in operating position in front of the machine. Provision has been made so that the machine must be stopped while speeds are being changed, thus providing positive protection against damaged gearing. The speed gears are of alloy steel hardened and run in an oil bath.

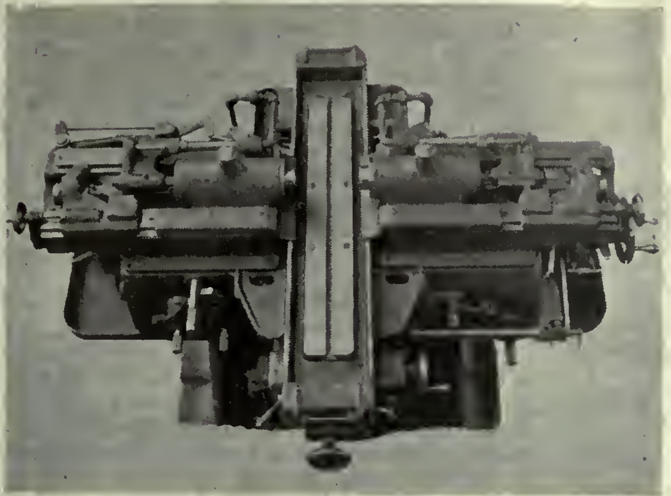
Ten gradations of feeds are available for the table. These are obtained from a speed box containing a cone of five gears and a two-speed clutch, controlled from the front of the machine. Each one of the ten gradations of table feeds



A PARTIAL FRONT VIEW OF THE MILLER.



THE MACHINE LOOKING FROM THE REAR.



A PLAN VIEW, ILLUSTRATING THE GENERAL DESIGN AND PROPORTIONS.

is available with each one of the six spindle speed gradations.

The work table obtains its motion through a lever from a cam mounted at the front under the work slide of the machine. This cam is driven by shafts and gears from the feed box. A simple, easily adjusted mechanism is provided whereby the table movement may be varied from zero to the maximum of six inches.

The feeds to the spindle housings are transmitted through crank and link mechanism from a cam mounted behind the table reciprocating cam just mentioned.

Following is a description of the manner in which the cutters are fed into the work:

At each end of the machine there is a small handwheel geared to a feed nut that turning this wheel moves the screw back into the nut. During this process that nut remains in fixed position lengthwise, but rotates, while the screw is pressed by a compression spring back into contact with the nut. Turning of the handwheel is continued until a pointer, moving over a graduated scale, assumes a position corresponding to the depth to which it is desired to sink the cutter into the work, this sets the depth of cut.

When the machine is started the feed mechanism causes the two feed nuts to rotate but as they are held against lengthwise movement the screws push the two opposed cutter heads inwardly against the pressure of the compression springs. Feeding of the cutter heads continues until the predetermined depth is reached at which point the screws run out of the nuts and feeding stops. In cases where the slot is milled through, as for instance the drift slot in drilling machine spindles, it becomes necessary to avoid leaving a small fin in the center of the work. This is accomplished by withdrawing one cutter just before it reaches the centre of the work and causing the other cutter to continue its feed movement beyond the center. After the centre of the work has been passed by this cutter the head which carries it recedes. This synchronized movement of the cutter heads is, of course, performed automatically by power.

In spline milling operations it is of the greatest importance to provide for efficient cooling of the cutters and work. With this in mind the cut lubrication system of machine has been developed along lines which afford exceptionally efficient results. A reservoir is secured to the door of the column within the body of the machine. When the door is opened this reservoir swings out with it and the supply of cut lubricant can be readily replenished or the reservoir cleaned. The coolant pump is driven at constant speed from the main drive pulley, thus making cutter spindles themselves. Passing through these and through grooves in the shanks of the cutters it is projected under considerable pressure direct on to the lips of the cutters, cooling them and at the same time ejecting any chips immediately they are formed.

Summed up the features of machine are as follows:

The machine is driven by a single belt direct from the line shaft. Although of compact design the machine will handle larger and longer work than previous models.

All controls; starting, stopping, feed, speed, adjustment of stroke, depth of cut, adjustment of table, placing of work, changing of cutters, etc., are operable from the front of the machine.

Provision is made so that the table, attached fixture and work as a unit are easily and quickly adjusted from the front of the machine is exact relation with the cutters after the work has been clamped to approximate position in the fixture.

In this machine but one cam of moderate size is employed. This is at the front of the machine below the work slide and does not project beyond the table travel.

The spindles are axially in fixed position in the bearings of their housings. The overhang is, therefore, constant for shallow or deep splines and is dependent on the length of the cutter iself. The spindles being thus axially fixed in the housings they are absolutely protected from the entrance of the cut lubricant into their bearings.

The adjustment is made by two handwheels conveniently placed at the front of the machine. The cutter spindles are lubricated by an efficient splash system. The locations of the cutter lips in the splines are at all times indicated on an easily read, plain flat scale on the spindle adjustment slide to the right of the machine.

The cutters can at will be made to advance either in unison or alternately and either to knock off in unison or alternately. This feature is controlled instantly by a conveniently located shifted knob. The cutter spindles can be locked while changing cutters. This is accomplished instantly from the front of the machine.

The cutters are held rigidly and concentrically in a chuck of special design. This feature, in conjunction with the fixed relation of the spindle bearings to the cutter, assures the cutting of slots of a width equal to the diameter of the cutter.

The cut lubricant is under uniform constant pressure. It is conducted through the spindles and projected through grooves in the cutter bodies directly on the cutter lips. Thus no adjustments are necessary as the stream of cut lubricant is at all times focussed on the cut, not only lubricating but on the rebound ejecting the chips the instant they are made. The incorporation of this cut lubricating system has made possible the installation of efficient guards which retain the coolant within the confines of the machine itself.

FRONT VIEW OF THE MACHINE.

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PRINCIPAL CONTENTS

Meeting the Exchange Rate

IT is evident that there is a growing tendency on the part of the American manufacturers to take Canadian money at par, or else to absorb part of the adverse exchange rate. The Oakley Chemical Co. of New York this week advised the Canadian trade, "All Canadian remittances made by draft on New York will be accepted, less allowance thereon of one-half of the current rate of exchange." In the same mail the Norton Co. of Worcester, Mass., wrote in part as follows: "We will be pleased to assist you by accepting Canadian funds in payment of your purchases." The exchange business is a nasty sinkhole for Canadian firms that have much to liquidate in the American market. It is absolutely a drain where no value is received, and there are many cases where it cannot be passed on to the public.

For instance, a Canadian firm making automobiles has already announced its selling prices for the year. It is caught now with from 15 to 18 per cent. on exchange for raw material it must secure from the States. It has no come-back. It must pay and lose.

American firms are making no mistake when they keep one eye on the future trade of this country. It is a serious error to get the 15 or 18 per cent. exchange so largely stuck in their eye that they cannot see past it to the greater things in the future.

* * *

NOW there is another phase to this exchange situation, and it cannot be overlooked if we ever expect to come even with the boards. The reason our money is discounted in United States is because we have bought much more from them than we have sold to them. The rebating or absorbing of the adverse exchange rate may alleviate the financial pains of some concerns for the moment, but what will it do? It will stimulate buying in the American market on the part of Canadian firms, and in this way aggravate an already serious situation, and create a problem that sooner or later must be liquidated by this country.

In a number of letters that CANADIAN MACHINERY has seen from American firms, written to the Canadian trade, it is stated that these firms have faith in the future of Canada. This country appreciates the compliment, and should seriously consider on what this faith is founded.

We speak glibly of OUR vast resources, of OUR mineral wealth, of OUR forests and streams, and of OUR broad acres. In some queer way we seem to imagine that these things are going to rise up and pay off all our obligations, restore to us a favorable trade balance with United States, and, in short, pull us out of all the holes into which our industrial and commercial laziness and indifference have dropped us.

Face the thing now. All these resources are not going to help us out to the extent of a dollar unless we are prepared to stop our short-day nonsense and get down to work. The confidence of American manufacturers in the ability of this country to discharge its obligations is based on the belief that we will produce sufficiently to place in the markets of the world as much as we take out.

Canadians should not be short-sighted in this matter. Remember—the action of American firms in taking Canadian money at par is only a stop-gap. The final solution rests with the Canadian people themselves—not with United States or any other country.

Our one sure way out rests in greater production and more hours, rather than in fewer hours and decreased output.

A Candid Admission

THERE is considerable significance in this despatch, coming from London, England:

> The General Federation of Trades Unions announces that during the last quarter 145,700 pounds was paid out by the organization in connection with the cotton employees and iron moulders' strikes.
>
> "The saddest thing," says the Federation in connection with the announcement, "is the failure of this expenditure to obtain anything beyond what might have been secured through negotiations."

If one were to apply the same reasoning to the steel strike recently staged in United States, similar results would be forthcoming. Right in our district we have similar examples.

Strike pay, at best, is a miserable joke to play on any home. It would bankrupt any union were it to attempt to stage a prolonged strike and pay to its members anything in keeping with the demands that are made on the family purse.

At this time of year the strike talk begins, becoming rampant about the first of May. If there are matters that need adjustment, try negotiation first. When the results of that are available, give it a big and a serious think before voting strike for the sake of a few cents an hour, or a few hours a week.

If there is a big, vital question up, where your rights are at stake, and where the only way open is to strike—then strike, and strike hard. But remember that in these days of high wages and short hours these cases are few and far between.

Do not make the serious mistake of allowing the professional agitator to think and decide for you. Remember, the men who make money out of strikes are not safe counsellors.

The peculiar financial conditions of the moment make strike talk dangerous this year. A slackening on this account, on top of all the other obstacles, such as shortage of material, exchange rates, etc., may be the final monkey wrench in the big wheel.

A real example of thrift is the man who is sifting ashes as religiously at the first of March as he did the first week he lit the furnace.

It's Easy to Get Out and Sell Machine Tools

By ARK

MR. JOSEPH PRUNE wanted to go on the road as a machine tool salesman. He heard that it was good business. In fact he knew of one chap who, in the war days, had written business amounting to $76,000 in one day. Joe reckoned that was a good living, more splendid than he had ever dreamed of. And so it was that friend Prune got past the switchboard girl, the private secretary and into the office of Mr. Machine Tool. Mr. Tool owned

"OUR LATHE HAS NO SWING. . IT IS PERFECTLY RIGID."

up to Mr. Prune that they needed a man, whereupon Mr. Jos. Prune admitted that he was certain he could sell machinery, as he had had his hands all over a machine when the war was on. He was head soda water man on rough turning operations and had never been fired. The war ended too soon.

Since the war-shop blew, Mr. Prune had sold several things. He had strengthened his manner of approach. He had read a book on "Closing Big Business," and as he strode into Mr. Tool's office he looked him in the dead centre of the eye and grasped his hand with a regular "Helloo, Steve" atmosphere.

Mr. Tool was very busy and he was short-handed, so it was that Mr. Prune sidled past, got his little tan bag, a short list of prospects, some literature and order forms and sidled out.

His list of prospects showed that John Screw Co. needed a lathe. Lathes were strong points for Mr. Prune. He had seen them in shell shops. He knew what they did. And so it was that Mr. Prune steered himself out to the premises of Mr. Screw. Now, Prune didn't take time to think what the John Screw Co. made. He didn't know that they specialized in toolroom stuff. He didn't know they were noted for being high class all through. And so it was that Mr. Prune simply butted in. He mentioned lathes. Mr. Screw pressed a button. A lad appeared, and left with instructions to ask Mr. E. X. Pert, the superintendent, to come in. Mr. Prune was asked to be seated. He let loose on Mr. Screw the first chapter of his book on "Closing Big Business." He was seeking to plant in Mr. Screw's head THE BIG IDEA. Mr. Screw seemed more interested when Mr. Prune spoke of the prevalance of the flu and how the steady winter weather was kicking the shins of the coal bin. At this point Mr. E. X. Pert came in. He seemed to be in a hurry, but Mr. Screw explained that Mr. Prune had a lathe proposition that might interest him. Prune took a look at Mr. E. X. Pert and suddenly remembered that he had charge of the shell shop where he (Prune) had been soda water squirter. He thought then that E. X. Pert had a soft job, so just to get on good footing with him he mentioned that he had been associated with him in winning the war. Mr. E. X. Pert did not seem much impressed, but asked Mr. Prune to go ahead and show what he had in a lathe.

"Our lathe," began Mr. Prune, "is a good lathe. It will do what we claim it will do. (Clears throat). It has given satisfaction in other shops and there is no reason why it should not give satisfaction here. It is made of good material and will stand up under hard usage."

Prune was not satisfied that he was going right. First chapter on "Closing Big Business" had mentioned impressing the prospect. But neither Mr. Screw nor Mr. E. X. Pert seemed impressed yet. Screw was already thumbing a pile of papers and the superintendent had glanced at his watch and measured the distance between Prune and the door. Prune cleared his tubes again as though to spray his victim with speech, but E. X. Pert beat him to it.

"Now, that's all right," he said, and there were brass tacks in his voice, "all this stuff is waste time. We want to know why your lathe is suitable for our work."

But Prune was ready. Chapter two in "Big Business" was on "Never Be Flabbergasted." So Prune smiled blandly at Mr. E. X. Pert, the sort of smile that was supposed to make technical detail smell like trifles. "Why, of course, Mr. E. X. Pert, we want to give you every bit of information we can."

"What swing has your machine?" started Mr. Screw's sup.

"None, whatever," replied Mr. Prune, with a deliberation that was tremendous, "bolted to the floor—perfectly rigid." Mr. Screw snickered, but by this time his back was conveniently turned, so Prune mistook the snort for a sigh of relief to think that such splendid advisory service was at his disposal.

"Very good," agreed E. X. Pert. "We are fond of rigid machines. Now about the bed, its width and length, and is it cone-driven or with geared head stock?"

"It has a good bed, good length and wide enough for the length. (Cough). The head stock is also good material. We never had any complaints about the cones either."

"Very good," assented E. X. Pert. "Now, the changes of feed and speed and in what ratio. Also, is there a universal or independent jaw chuck, pipe, or just an ordinary centre for the tail stock?"

Mr. Prune got another leg wound around the leg of

E. X. PERT'S HAND WAS ON HIS NECK.

the desk and grasped the darn thing with the free fist that wasn't hugging the little yellow bag. What the sam hill did this man want to ask so many questions for. Chapter three in Big Business said: "Never Be Bluffed." So he'd show Mr. E. X. Pert just where he got off at.

Continued on page 54

MARKET DEVELOPMENTS

More U. S. Firms Accepting Payment at Par

Matter of Convenience to Canadian Firms—No Improvement in the Supply of Steel Coming to This Country—Tubes and Sheets Scarce—Supplies Increased in Price

THERE is a noticeable increase in the list of American firms that have expressed their willingness to accept payment of accounts in Canadian currency at par. Payment of exchange becomes a more serious matter for many Canadian firms who have to settle for large purchases of material across the line that they cannot secure elsewhere.

It would take a confirmed optimist to find any improvement in the steel supply situation. The remarkable thing is that nearly all the business that is sagging the books of the mills remains good, cancellation being rare. Of course, many of the mills refuse to cancel, holding to the principle that a contract is a contract. The shortage of sheets and tubes is becoming a more serious matter than was thought possible a month ago. There are large repair works held up because tubes are not forthcoming. This refers to regular, standard sizes and lengths.

Warehouses are facing a peculiar position, and so are the agencies for the steel mills. They are witnessing business in large quantities coming to their door every day of the week begging acceptance, and they know they are not in a position to entertain a bit of it. It is surely a long cry from the situation that existed barely six months ago when these same people were out trying to make the trade see the wisdom of coming into the market and covering their requirements.

Makers of many lines of machine tools announce an increase of ten per cent. this week. This refers to some firms both in Canada and United States. Price revision is likely to be general in Canada if the exchange keeps at its present figure, as many manufacturers have to pay the peak exchange rate on their raw material. Makers of taps and dies have given notice of a ten per cent. increase, and instructions have also been given to dealers not to quote carbon drills at old prices.

The scrap metal dealers find it to their advantage to ship as much material as they can into the U. S. markets to take advantage of the exchange.

SICKNESS AND SHIPPING TROUBLE ARE BOTHERING MONTREAL TRADE

Special to CANADIAN MACHINERY.

MONTREAL, February 26.—Several circumstances combine to make the present week a comparatively quiet one, both in commercial and industrial circles. Many of the larger concerns are considerably handicapped by absence of employees on account of sickness, and this has had the effect of general inactivity all along the line. The curtailment of activity, as a result of a quieting down in the business done between here and the States, is another feature that emphasizes the uncertainty that prevails in present trading. Delays in shipping and receipt of materials is another factor that adds to the difficulty of solving the present complex situation.

Steel Lines Still Scarce

The steel situation is one where it taxes every effort of the dealer to meet the constant needs of customers. In the opinion of steel men here the present unsatisfactory conditions will continue for some indefinite time, as reports from dealers that have visited the mills in the States, with a view of picking up material, are not of an optimistic character. Labor conditions are such that production is considerably below what is possible, and with the steady cry for more steel from every line of industry the scarcity of material must remain a pronounced feature of present business. It is expected that the opening of the new Canadian plate mill at Sydney will assist in relieving a condition that is daily becoming more pronounced. This new source of supply will help out any heavy demand for plates but will not aid in giving much relief to the urgent and constant demand for more sheet lines. The local condition noted last week, namely, a nominal market, is still effective, as individual sales determine the price on which each sale is made, the basic prices quoted serving only in a general way. Present warehouse stocks of tubes and sheets, both black and galvanized, are quite low, and standard sizes are very difficult to obtain.

Used Tools Again Active

A feature of recent activity in regard to machine tools has been the increased demand for used equipment. The requirements for new tools is still of considerable volume, but the difficulty of obtaining supplies from the States continues to hinder the maintenance of normal business from American manufacturers. Tentative arrangements have enabled some of the machine tool dealers to secure machinery on a basis satisfactory to their customers, but the burden of high exchange is still a deterring factor in carrying out any excessive plans for additional expansion or factory development, many contemplated moves in this direction being temporarily suspended, awaiting more favorable trade conditions. It is believed that several inquiries for equipment, of varying volume have been withdrawn, as manufacturers here are reluctant to pay the high rate now effective. While this condition has resulted in diverting some business to Canadian houses it has had the effect, also, of holding up other business, where the delivery of tools available here would not suffice for the delay in obtaining the machines that must needs come in from the States. In this way what tools could be secured here are not ordered, as little would be gained by securing some tools and not the others. This situation is one that should awaken the Canadian maker of machine tools and show them the advantages that would accrue by supplying a need that, up to the present, has been taken care of by American makers.

The Need Decides the Price

There is little of interest to report in the old material situation as dealers report a quiet week in all classes of scrap. The feature of present trading is in the distribution of cast iron scrap and the market in this respect is very strong owing to the pronounced scarcity of material. The market is a selling one and the prices ruling and the difficulty of supplying the demand indicates that all available cast scrap is in a transient condition. Dealers are satisfied to let quotations stand, as there is little to be gained in quoting prices when actual sales are made more on the nature of the need than any particular price.

INCREASES COME IN SEVERAL LINES

The Securing of Steel Supplies Has Become a Complicated Piece of Business

TORONTO—Price changes are frequent this week, but in no instance have we come across a case where any dealer has announced that the price change had anything like a downward tendency attached to it. It seemed a while ago that prices had gone to the limit, but the exchange can be blamed for some of them, as it is necessary to bring in so much raw material from United States, on which the exchange must be paid. Makers are not anxious to have prices go to higher levels, in fact they would welcome an opportunity to bring them to a lower plane. As a general thing machine tools are about twice what they were before the war. Nearly all the standard lines have sent out notices that prices have advanced ten per cent. On top of this put from fifteen to eighteen per cent. exchange, and a peculiar situation is created.

The list grows of those firms that are willing to accept payment of Canadian accounts at Canadian banks at par. Others are splitting the discount with Canadian firms, all of them having a tendency to make business conditions a little easier. It is a serious matter for a number of manufacturers who have contracts for supplies on the other side and which they cannot secure in Canada. Many business men see in the present situation a lesson for the people of this country on the need of greater production in order that the condition may be righted. Some firms have long lists prepared of firms who are willing to forego the exchange rate, and the total makes a goodly showing now.

Some of the concerns are wondering just how they are going to handle business in future. They are taking in material now, some of it for stock, and paying for it with a peak exchange rate of around 18 per cent. They are certain that rate will go down later on, and then they will be in competition with cheaper goods. The result is that many of them are keeping their buying right down to what they must carry in order to look after their trade. In this case they are simply adding the exchange to their selling price.

Speaking to CANADIAN MACHINERY this week one Toronto dealer said: "I noticed in your paper last week that some of the firms here had quoted a definite price, and allowed too little for exchange, and that they were losing money now on deliveries. We have not lost in this way. I don't think a consumer should expect a firm to bear the loss that is incurred by reason of exchange—something they cannot control—coming in and changing the selling price. We have met that situation like this: We simply explain to our customers that we allowed a certain rate for exchange, and that if at time of delivery the rate is lower they get the benefit, and if it is higher, they will be expected to put up the difference. We have not met any objection to this way of doing business. There is no reason why a dealer should be called upon to bear the brunt of the exchange rate."

There are a number of good inquiries in the market at the present time, some of them representing the expenditure of large sums of money. There are a number of small and large projects under way, and in many channels it seems that there is going to be a great deal of development this year.

Increase in Some Lines

Dealers have been notified that there has been an increase of ten per cent. in the price of taps and dies. For some time they have been selling at about 50 off the list. There is now a difference in the method of selling, as the number of different classes for discounts has been increased. The sizes mostly called for are 1-4, 5-16 and 3-8. The increase announced will amount to ten per cent., and is dated to become effective on the 23rd. This is the first increase that has been made in the prices of taps and dies for some time—in fact it must have been a year or over since they have been altered.

It was intimated in these columns some time ago that there would be an increase in the price of Canadian carbon drills. The new lists have not been issued at this writing, but dealers have received notice not to quote carbon drills at the old prices, so they take it from that that the new lists will be mailed to them any time now.

There is a nice volume of business moving in small stuff. Large orders are not very plentiful, as several of the largest buyers bought very heavily some time ago, and so they are more or less out of the market in consequence.

A Starved Market

Even the most optimistic can hardly put a finger on anything that shows improvement in the steel market. If there is any change it is not for the better. Added to the other features that have been hindering progress there has been a shortage of cars and a shortage of coal to keep the trains in operation. This refers not only to shipments going some distance, but also to the shipping of material from plant to plant until it reaches the finishing mills.

Plate is the one best feature, but where there is anything like a decent delivery promised it is invariably tied up with a demand for a stiff premium.

One thing seems certain, and that is that in spite of all the delay and the manner in which delivery schedules are stretched to months in advance, most of the business booked remains good, and there are very few cancellations. Some of the mills insist on doing business on the hard and fast rule that a contract is

POINTS IN WEEK'S MARKETING NOTES

The exchange rate provides an incentive to scrap metal dealers to export as much as possible to U. S. buyers.

—

A number of price changes are announced. Many makes of machine tools go up ten per cent. Taps and dies are similarly advanced, while the old prices on carbon drills have been withdrawn.

—

A large number of American firms have sent word to Canadian customers that they are prepared to absorb the rate of exchange and accept Canadian money at par in a Canadian account.

—

Boiler tube shortage is a serious matter with a number of firms, and a large amount of repair and rebuilding work has been held up in consequence. Even standards are impossible to secure.

—

Transportation troubles are holding up a lot of steel that otherwise would be in Canadian warehouses now.

—

Plate production shows some signs of improvement, but the premium market is still active, and good delivery generally carries a good price.

—

New York begins to wonder how much longer the automobile trade can or will stay in the market as the greatest purchaser of machine tools.

—

One Pittsburgh mill is reported as offering $80 for sheet bars for conversion.

—

American rolling mills continue to turn down practically all the business offered. There is a feeling growing that it is inadvisable to keep on booking business for delivery twelve months off.

a contract, while there are others that never press an unwilling buyer.

Sheets and boiler tubes are wanted, and wanted badly. There are places where a lot of repair work is being held up on account of inability to secure tubes. One firm in particular that does a lot of heavy boiler work is out trying to secure a supply of 4-inch 18-foot tubes, but they cannot locate anything in this line.

The Scrap Metal Trade

Prices are well maintained in the scrap metal trade, and a fair amount of business is being done. Dealers are finding it very advantageous to export as much as possible to American points, the rate of exchange more than offsetting the rather low prices prevailing there at present.

No improvement is noticed in the lines where shortage prevails, especially cast iron scrap of good grade. Some small lots of this have been changing hands, and as high as $38 was paid.

NO LET UP TO THE BUYING THAT THE AUTO BUSINESS DOES IN U. S.

Special to CANADIAN MACHINERY.

NEW YORK, Feb. 26—Though there is a degree of uncertainty in business circles, due largely to the money situation, which has been reflected in some degree in machine-tool inquiry and buying, machine-tool business, as a whole, continues to be very satisfactory. Probably some buying has been held up, and sellers report a falling off in inquiries, this has not excited much apprehension yet, because the machine-tool manufacturing plants have all the orders they can handle for the next three to nine months. Some companies are sold up practically for a year.

An adverse factor is the railroad transportation situation. New England is in worse shape than most sections of the country, and some cities in that section have been under absolute embargo for weeks. Nothing but warmer weather can alleviate the tie-up of freight.

There has been some fairly large buying in the East in the past week or 10 days. The Westinghouse Electric Mfg. Co., South Philadelphia, has bought some tools to equip additions to its plant; the New Britain Machine Co., New Britain, Conn., has bought 50 machines; the Willys Corporation, Elizabeth, N.J., has added about $150,000 worth of orders to its recent purchases, its total purchases in the past two months having run well over $1,000,000, possibly as much as $2,000,000. Many other concerns have been active, and there have been several sales of tools totalling from $10,000 to $25,000.

Railroads are inquiring, but have done very little buying. It is expected that some business from this quarter will develop after the return of the roads to private ownership on March 1. Among those which have made known their needs of equipment are the Pennsylvania, Baltimore & Ohio, the Nickel Plate, Missouri, Kansas & Texas and the Boston & Maine.

A matter of concern to the machine-tool trade is, how much longer can the unprecedented buying of the automotive industries continue? There appears to be no let-up at present, and much of the business of the past few months has emanated from companies which either manufacture automobiles or parts and accessories. In the Philadelphia district there will shortly be two new plants, one to be built by the Fox Motor Co., Philadelphia, which will manufacture an air-cooled motor, and the other by Dupont Motors, Inc., now at Wilmington, Del., which will build a plant at Moore, a suburb of Philadelphia.

A WEAK EFFORT BEING MADE TO STABILIZE THE PLATE MARKET

Special to CANADIAN MACHINERY.

PITTSBURGH, Feb. 26—There is nothing like unanimity in appraisals of the car supply situation made by different shipping interests, and after a little investigation the close observer is disposed to conclude that the personal element enters, appraisals being subject to a personal equation. There is no definite evidence that the situation as to there being a free movement of finished products from steel mills, bringing the necessary relief, yet there is no assurance that the situation has grown any worse. It is believed that there is more steel at mills awaiting shipment than there was a week ago, or even two weeks ago, but at any rate the accumulation has not been more rapid this week than formerly, and the mills can still store away some of the finished product before reaching the limit of their storage facilities. In some cases there are reports that there is no more accumulation than existed six weeks ago. An illustration is given in one large producer of finished steed having had an operation better than 90 per cent. since the first of the year, and having no more material on hand now than on January 1.

Instead of a letting up in the demand for plates it has increased in the past two weeks, if prices that can be obtained are any criterion. One fairly large producer who has always been a conservative seller was quoting as high prices as seemed possibly obtainable, 3.50c and higher on fair-sized lots, but soon became so well sold up that it was decided to sell no more at any price, and he is now out of the market for an indefinite period. One particular cause of high prices for plates that seemed important two or three months ago, restricted production, can no longer be regarded as an important factor, as the plate mills, generally speaking, are doing quite well in point of tonnage. One or two independent interests, strongly disposed to stabilize the plate market, are quoting plates to regular customers in a limited way of 3c, but this figure is to be regarded simply as a settling price for regular customers, as such mills do not sell in the open market at all. The general plate market is quoted at 3.50c to 4c.

In line with other products, the sheet trade reports transportation conditions as execrable, which has resulted in an increased shortage of sheet bars as well as of loading facilities for the finished product. Sheet consumers are working very hard to secure larger deliveries, which are very large as it is, but it seems as if the consumers want to operate at greater rate than at any time in the history of the trade. The American Sheet and Tin Plate Company was very short of steel this week, and operated their mills at an average of only about 70 per cent. of capacity. Part of the week they were operating at only 60 per cent. There is no general market, as far as prices are concerned, but an upward tendency is seen in various descriptions of material and the various deliveries. There was a rumor this week that a sheet consumer had bid $80 for sheet bars for conversion, which shows that anxiety exists to secure sheets at not less than 2c premium, which it would be if the $80 price was negotiated.

The tin plate mills have not complained so much of car shortage as some other parts of the iron and steel trade, but it is known that considerable material has been piled up in warehouses, and if the car supply is not better next week there will be a curtailment of production. While not many of the makers seem to be suffering for lack of steel, none of them are getting as much raw material as they would desire, in view of the backlog of old business. There are heavy demands for tin plate, and sales at $20 to $30 a ton above the recognized base readily might be made to domestic consumers if makers were disposed to forget present obligations. While it is probable that some of the smaller makers are doing business at premiums, the most important producers are adhering to the old base of $7.00, Pittsburgh, and paying more attention to business already behind in fulfillment by reason of mill interruptions in the last three months of the old year. As regards export business, prices run from $8.50 to $9.50, Pittsburgh.

Shipments of sheets and supply of steel are being kept down by lack of cars, and very few of the tin plate producers are able to get to the point warranted by the volume of orders booked and the fact that there is no letup in demand.

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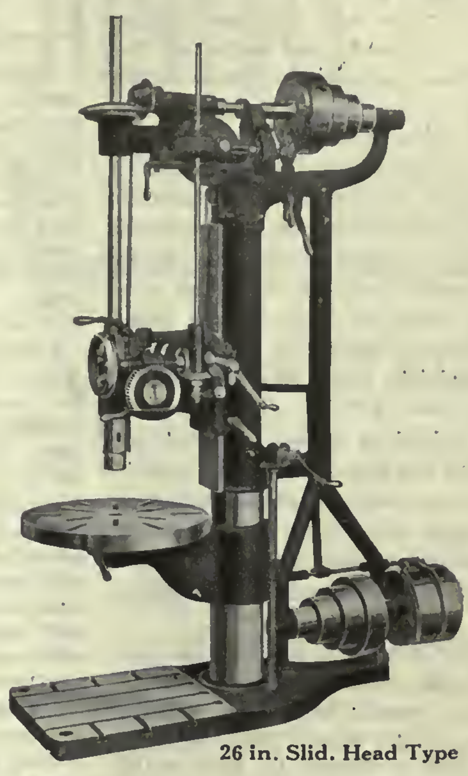

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IMPERIAL

INGERSOLL

There has been a heavy demand for spikes, but the makers are so well filled up with orders that they are turning down all inquiries for new business. The big railroad systems have given orders recently to the makers, especially for standard spikes, that will keep the mills going for several months to come, and makers will not sell further ahead on account of the uncertainty of supplies and prices of steel bars. Two of the largest makers here are out of the market, and refuse to quote prices. Standard spikes run from 3.75c to 3.85c, base, for carload lots, while small spikes are quotable from 4.25c to 4.50c, base, in lots of carload or more. It is not believed that less than 4c would be considered on large railroad spikes from irregular buyers, while small spikes are not available for buyers seeking supplies outside their regular sources much below 5c.

Bessemer and basic pig iron has not changed this week, both grades being quiet. The market stands as follows: Bessemer, $42; basic, $43; foundry, $42.00. This is unusual for basic to be above Bessemer, and was brought about a few days ago by basic demand having taken a spurt. A few pig iron producers are talking of $50 iron in the near future, and some profess to believe that it will reach $60.

There is little change in the coke market, which is well defined at the Government limits, $6.00 for furnace and $7.00 for foundry.

U.S. SCRAP METAL

The scrap market is softening considerably, and there is a downward trend to prices all over. Following are reports from various United States centres:

CHICAGO: — While quotations are practically nominal, the trend of business that has been done has been to lower prices. The steel making grades have gone back $1 per ton in most grades. The resumption of a buying movement would stiffen prices rapidly.

BOSTON:—There has not been much change in prices, though heavy melting has weakened a little more. The car situation has much to do with the market here. Thus cast grades have been short, and prices have stiffened.

PHILADELPHIA:—The market is generally weak, and there has been considerable liquidation by dealers which is still continuing on a smaller scale. Some grades such as railroad wrought, cupola cast, stove plate and fire bars have stiffened somewhat.

BUFFALO:—The market is not very active here, and car shortage and labor shortage are handicapping dealers in getting out tonnage already sold. Cast scrap stove plate and car wheels are in good demand. Stove plate is at $30 to $31.

BIRMINGHAM: — Quotations are somewhat higher on many grades, but heavy melting, which is not in much demand, has weakened slightly. Southern scrap cannot enter other markets on account of the high freights that have to be paid.

PIG IRON TRADE

The demand for pig iron has quietened down, after a fairly large buying movement. A feature of the situation is an embargo on New England points. Following are reports from various U.S. points:—

CHICAGO:—Enquiry for last half is in evidence here, prompt and second quarter demand being lighter. A sale of 35,000 tons foundry iron is reported for the Ford Co. Prices are about the same: $43 for Chicago iron; furnace for last half and southern iron $40, Birmingham.

PHILADELPHIA:—There has been a quieter week, most of the business being done in foundry iron, although there was a fair amount of off-iron sold for prompt shipment. Pennsylvania iron No. 2 plain is at $42 furnace in the central district, while Eastern Pennsylvania iron is $44 to $45 furnace for No. 2X.

NEW YORK:—Embargoes and severe weather have had the effect of curtailing foundry operations to some extent. Reports from the United Kingdom state that English and Scotch producers are sold up. This is expected to lead to more heavy buying here.

PITTSBURGH:—There is a distant lull in the market, due to a combination of circumstances including the quiet period after a heavy buying movement, the exchange situation, and the stock market. At the same time there are some heavy enquiries uncovered, chiefly for basic. Producers are quoting $45 for this grade.

IT'S EASY TO GET OUT AND SELL

(Continued from page 231)

The last question he remembered was about a tail stock. Chucks and the universe also lingered in the rear.

"The tail is made of good stock, I can assure you. We never had any of these break. (Swallows a lump). The chuck also goes with the machine, and as you said, it is known all over the universe. And as far as speed is concerned, say, Mr. E. X. Pert, she has some speed. We never had any complaints that she wasn't speedy enough."

"Mr. Prune, just a couple of other details. I mustn't take too much of your time."

Chapter four of "Big Business" had said, "Never appear in too great a hurry," so Mr. Prune assured Mr. E. X. Pert that it was his business to circulate and give the mechanical world the benefit of his expert knowledge.

"There's one point that is necessary for us to know," went on Mr. Screw, who had by this time wheeled around and taken an active interest in the onslaught. "What sort of bearings has the spindle got, and what is the ratio of the back gearing?"

"Don't worry about the spindle," broke in Prune, "it will be bearing all the load that's put on it, and as for the ratio—that also goes with the machine. Some firms regard them as extras, but we don't. We put on both the spindle and the ratio, but, of course, we charge for extra sets of back gearing. Now, gentlemen, how about the order? (Chapter five of "Big Business" had said to always keep in mind the closing of the contract), and Prune was already fumbling in his pocket for the yellow slip with the dotted line.

"Just one more detail," broke in E. X. Pert. "How do you convert the feed to the lead screw from the apron?"

"Just so—just so," sputtered Mr. Joseph Prune, "that is a matter about which one must use a great deal of discretion. You see, it depends altogether on the class of work and to who is operating the machine. Very few people wear aprons now, as they are apt to be caught in the belting. And as to converting the feed to the lead screw I can assure you that both the feed and the lead screw are quite convertible. Not only so . . . ."

"You better do it," was all that Mr. John Screw stage-whispered to Mr. E. X. Pert, "I haven't got the heart, and I'm wearin' my best suit to-day."

Whereupon Mr. E. X. Pert thumped the table so hard that Prune's yellow bag fell on the floor, and by the time he could untwist his leg from the friendly limb of the desk, the superintendent was laying a firm hand on his neck.

"Mr. Joseph Prune, you were head soda-water man in the shell shop—soda water's your line. Attend to it in future. Take your little yellow bag, your literature and your carcass. Remember those little murder charts in the papers, 'Dotted line indicates the direction taken by the body as it was hurled through the door.' Now, you've got a chance for one minute to spare that part of the chart. The door is in the same place as when you came in. Close it on the outside or there will be one grand universal chuck landed right on your face plate. Mr. Prune, pardon these words, but good-day and good-bye."

And that night in his hall bedroom, Prune sucked the butt end of a cigarette and wrote to the publishers of "Big Business," cancelling Vol. II, and also intimating that Vol. I was no darn good.

CANADIAN MACHINERY AND MANUFACTURING NEWS

Vol. XXIII., No. 10 March 4, 1920

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Canadian Firms Bidding Now for World Trade

Big Exhibition for Overseas Buyers to be Held in London in June —Large Number of Canadian Firms Are Going to Have Representative Exhibits There

THE enthusiastic interest aroused among the industries of the Dominion by the announcement of the great Canadian Industries Exhibition to be held in London next June has produced a remarkable crop of applications for space, as the result of which the greater part of the Agricultural Hall, vast as it is, has already been allotted to intending exhibitors. In addition, a great number of firms have secured options on positions, and many more who have expressed their interest in the Exhibition will doubtless be added to the list of exhibitors when details have been arranged between them and their agents in Great Britain.

Sir George Foster's Support

The exhibition has been strongly recommended by the Canadian Manufacturers' Asociation, and is actively supported by the Canadian Trade Commission, the Department of Trade and Commerce, Ottawa, and the Canadian Mission in London; but, without that, manufacturers and producers were quick to realize the splendid opportunity London affords for an introduction to the world's buyers, and, in many cases, the wish has been expressed that the exhibition should be held periodically as the recognized medium of showing the progress of Canadian productions. Sir George Foster, the Canadian Minister of Commerce, has succinctly stated the general feeling towards the enterprise in Canadian industrial circles in his letter to the Manufacturers' Association, recommending its members to participate.

"I desire" (writes the Minister) "to commend the Exhibition to the thoughtful attention of manufacturers and producers. It opens up one of the quickest possible opportunities of practically and efficiently representing Canadian products to a large clientele, of following up the work of the Canadian Trade Mission, of continuing connections already made, and opening new ones for the extension of our export trade, all of which are vitally necessary in Canadian interests. We should lose no ground already gained, and should make every endeavour to take advantage of present conditions in the British market to secure a permanent foothold in the great trade exchanges centred in Britain.

Yours, etc.,

(Signed) George E. Foster."

Firms To Be Represented

While negotiations for space are in progress with so many firms, it would be unfair to give a list of exhibitors; but we may say that all the firms mentioned below are expected to be represented at the Exhibition:—

Canadian Export Association, Ltd.
Chase Tractor Corporation.
Massey-Harris (agricultural machinery).
Cockshutt Plow Co.
International Harvester Co.
Goodyear Tire Co.
Canadian Biscuit and Confectionery Association.
Acadia Gas Engine Co.
Nielsen's, Ltd. (chocolates).
Willard's, Ltd. (chocolates).
Staunton's, Ltd. (wallpapers).
Reg. N. Boxer Co., (wallpapers).
Sheet Metal Products Co.
Dominion Steel Products Co.
Steel Co. of Canada.
Shawinigan, Ltd. (chemicals).
Canadian National Railways.
Canadian Pacific Railway.
Stevens & Co. (canned fruits and foods).
Ludgate, Ltd. (office furniture, etc.).
John Morrow Screw & Nut Co.
Eisman & Co. (elastic goods).
Beatty Bros. (washing machines, etc.).
A. Boake, Roberts & Co. (chemicals).
S. D. Simond & Co. (provisions).
Hargreaves & Radclyffe (wood working machines).
Empire Typewriter Co.
Canadian Chicle Co.
British-American Nickel Corporation.
Canada Cycle & Motor Co.
Kindel Bed Co.
Canadian Pulp and Paper Association.
Dominion Textiles.
Office Specialty Manufacturing Co.
London Concrete Machinery Co.
McClary Manufacturing Co. (hardware).
Empire Manufacturing Co. (plumbers' supplies).
Battle Creek Toasted Corn Co.
McCormick Manufacturing Co. (biscuits).
Spramotor Co. (spraying machines).
Nova Scotia Steel Co.
Dominion Battery Co.
Canada Malting Co.
Silver Bros. (furs).
Marsh Engineering Works.
Canadian Des Moines Steel Co.
Small's, Ltd. (syrups, etc.).
H. E. Furniture Co. (kitchen cabinets).
Pedlar People, Oshawa (sheet metal products).
Beach Furniture Co.
E. T. Wright & Co. (metal sundries).
Sherlock Manning Piano & Organ Co.
J. B. Keeble & Co., Ltd.
Dominion Paint Works.
Canadian Polishes, Ltd.
Canada Foundries & Forgings, Ltd.
J. H. Gignac, Quebec (lumber).
Petrie Mfg. Co. (cream separators).
Dominion Machinery Co.
Iona Gypsum Co.
Canada Overseas Trading Co.
Anglo-Canadian Homes Construction Co.
Dominion Industries, Ltd.

A Wide Range of Industries

This list is only a selection of the firms interested as exhibitors or possible exhibitors, but should serve to give British and other overseas buyers some idea of the wide range of Canadian industries now actively interested in export trade, and which are contemplating, if they have not decided to do so, going to London next June to show buyers their productions and negotiate business.

CANADA CAN HOLD HER PLACE IN SOUTH AFRICAN BUSINESS

WILL Canadian trade hold its place in the South African field when it has to meet world competition? Mr. W. J. Egan, Canadian Trade Commissioner in South Africa, thinks it will.

Interviewed in London by "The Pioneer," prior to his sailing for Capetown, Mr. Egan said that with developments in sight in the mining and agricultural industries of South Africa, Canada could, in a few years, be in a position to ship $25,000,000 worth of goods to that country. However, to do so, Canadian manufacturers must be prepared to compete. There was no limit to the possibilities of the trade which might be done in rails, wire, steel, and corrugated iron manufactures if Canadians would go in for this business on a large scale. In this connection, Mr. Egan thought the reorganization of the Dominion Steel Company, recently announced, might portend some development of this kind. As regards other lines, the Trade Commissioner thought the Dominion could hold its position in the South African paint and varnish market, even when British competition was again a factor. He did not think British manufacturing conditions would ever be on the old pre-war basis again.

Despite the drop in sterling, he continued, South African exchange was not actually against Canada in the sense that as yet our competition came from the United States, whose exchange rate was even higher. When British exports again commenced to pour into the South African market, the situation, of course, would be different. As compared with the United States, the rate was in Canada's favor, but this was offset to a certain extent by the fact that some large firms quoted in New York instead of Montreal, in order to meet bills which they might have in America. This practice was to be deplored.

Mr. Egan, who had intended to spend six weeks in Canada, spent almost six months there, and in this time interviewed some 450 firms interested in the South African trade. Over 140 Canadian firms have asked him to secure representation in this field, and twenty-one companies are sending out their own representatives to study the situation. Twenty-seven agency arrangements were made by South Africans who had visited Canada on Mr. Egan's recommendation to secure agencies.

Mr. Egan said industry seemed to be at its best in Canada at present. There was a shortage of labor, particularly female labor, but demobilized men were settling down rapidly. Activity was noticeable in the Canadian textile industry, which had taken giant strides since he had last been in the Dominion. The banks were also interesting themelves very helpfully in export trade.

Ninety per cent. of Canadian manufactures would find some market in South Africa, said Mr. Egan in conclusion. He also found while in Canada a considerable interest in the possibilities of German Africa, recently annexed.

CANADIAN TRADE COMMISSIONERS

Canadian Trade Commissioners and Commercial Agents should be kept supplied with catalogues, price lists, discount rates, etc., and the names and addresses of trade representatives by Canadian exporters. Catalogues should state whether prices are at factory point, f.o.b. at port of shipment, or, which is preferable, c.i.f. at foreign port.

Argentine Republic—B. S. Webb, Canadian Government Trade Commissioner, Reconquista No. 46, Buenos Aires. Cable address, Canadian.

Australia—D. H. Ross, Canadian Government Trade Commissioner. Address—for letters, Box 140 G.P.O., Melbourne; office, Stock Exchange Building, Melbourne. Cable address, Canadian.

Brazil—G. B. Johnson, Canadian Government Trade Commissioner. Address for letters—Caixa (P. O. Box) 2164, Rio de Janeiro; office, Rua Gonçalves Dies 30, Rio de Janeiro, Brazil. Cable address, Canadian.

British West Indies—E. H. S. Flood, Canadian Government Trade Commissioner, Bridgetown, Barbados; agent also for the Bermudas and British Guiana. Cable address, Canadian.

China—J. W. Ross, Canadian Government Trade Commissioner, 13 Nanking Road, Shanghai. Cable address, Cancoma.

Cuba—H. A. Chisholm, Canadian Government Trade Commissioner, 501 and 502 Antigua, Casa de Corres, Teniente Rey, 11, Havana. Cable address, Cantracom.

France—Hercule Barré, Canadian Government Trade Commissioner, 17 and 19 Boulevard des Capucines, Paris. Cable address, Stadacona.

Holland—Ph. Geleerd, Acting Canadian Government Trade Commissioner, Zuidblaak 26, Rotterdam. Cable address, Watermill.

Italy—W. McL. Clarke, Canedian Government Trade Commissoiner, via Carlo Cattaneo, 2, Milan. Cable address, Canadian.

Japan—A. E. Bryann, Canadian Government Trade Commissioner, 53 Main Street, Yokohama. Cable address, Canadian.

Newfoundland—W. B. Nicholson, Canadian Government Trade Commissioner, Bank of Montreal Building, Water Street, St. John's. Cable address, Canadian.

New Zealand—W. A. Beddoe, Canadian Government Trade Commissioner, Union Buildings, Customs Street, Auckland. Cable address, Canadian.

Siberia—H. R. Poussette, Acting Canadian Government Trade Commissioner, Aleutskia No. 11, Vladivostok. Cable address, Canadian.

South Africa—W. J. Egan, Canadian Government Trade Commissioner, Norwich Union Buildings, Cape Town. Cable address, Cantracom.

Southeastern Europe—L. D. Wilgress, Canadian Government Trade Commissioner, c/o Canadian Trade Commissioner, via Carlo Cattaneo, 2, Milan, Italy.

United Kingdom—Harrison Watson, Canadian Government Trade Commissioner, 73 Basinghall Street, London, E. C. 2, England. Cable address, Sleighing, London.

J. Forsyth Smith, Acting Canadian Government Trade Commissioner, 87 Union Street, Glasgow ,Scotland. Cable address, Cantracom.

J. E. Ray, Canadian Government Trade Commissioner, 4 St. Ann's Square, Manchester. Cable address, Cantracom.

J. Forsyth Smith, Canadian Government Trade Commissioner, Century Bldgs., 31 North John Street, Liverpool. Cable address, Cantracom.

N. D. Johnston, Canadian Government Trade Commissioner, Sun Building, Clare Street, Bristol. Cable address, Canadian.

CANADIAN COMMERCIAL AGENTS

Australia—B. Millin, Canadian Government Commercial Agent, the Royal Exchange Building, Sydney, N.S.W.

British West Indies—Edgar Tripp, Canadian Government Commercial Agent, Port of Spain, Trinidad. Cable address, Canadian.

R. H. Curry, Canadian Government Commercial Agent, Nassau, Bahamas.

Norway and Denmark—C. E. Sontum, Canadian Government Commercial Agent, Grubbegd, No. 4, Christiania, Norway. Cable address, Sontums.

BIG EXHIBITION NOW PLANNED FOR LONDON

The second International Engineering and Machinery Exhibition will be held in London from 4th September to 25th September, 1920, and it is already known that the Exhibition will contain the finest and most comprehensive display of machine tools and workshop equipment ever seen at an Exhibition in any country at any time. About two hundred firms, consisting of members of the British industry, will exhibit, and at present, more than six months before the opening, the whole of the ground floor and two-thirds of the gallery space have been allocated.

A comprehensive catalogue, which is expected to run to 350 pages, will be printed, and this will form a permanent book of reference for buyers of machine tools and workshop equipment generally.

The Machine Tool Trades Association, under the auspices of which the Exhibition is being held, is the representative association of British Machine Tool Manufacturers, exceedingly anxious that overseas buyers should have every opportunity of visiting this exhibition. Season tickets admitting to the exhibition on every day will be sent by the secretary to any overseas buyer who is likely to be in England during the run of the exhibition. Engineers and others who are not themselves buyers, but who are interested in some way in the furtherance of export trade of British goods of this kind, may also receive such season tickets, for which application should be made to the Secretary, Machine Tool Trades Association, Queen Anne's Chambers, Tothill Street, London, S. W. Officers of the Department of Overseas Trade are requested to make this exhibition as widely known as possible to foreign buyers and others who may be interested.

PACKING MACHINERY FOR SOUTH AMERICA

Some Suggestions that Should be Noticed in Successful Shipping is to Result

A mechanical engineer with many years of experience on the west coast of South America has given H.M. Commercial Secretary at Lima the following note on the packing of machinery, particularly electrical machinery, for South America:

All engineering plant should be packed in strong, braced, open cradles of deal, and these cradles should again be packed in a heavy deal packing case, fitted with battens and, if possible, with diagonal braces. Machines must, under no circumstances, be bolted down to one side of the case. There is no objection, however, if the opposite side of the machine is bolte dto the case, too. It is much better, however, to pack the goods in a cradle and to make the cradle fit year (1918) will enable one to realize the case exactly, so that, even if the case is dropped, the stress is distributed equally all over the case and not on any one side or end.

All such small fittings and projections as handles, levers, valves, pressure gauges, etc., should be detached and packed tightly with wood wool into a small, strong wooden box, firmly screwed on to the inside of the main case or cradle. Any moving parts (as armatures of electric motors) must be wedged tight relatively to the fixed portion, to prevent oil rings being sheared off, bearing shields broken, and other damage occurring.

Any case containing machinery should be capable of being dropped fifteen times from a height of one metre on to a concrete floor without injury to case or contents. This represents the average history of a case of machinery leaving the United Kingdom or America, and arriving on site at final destination. So few breakages have occurred with this system of packing over a very large number of consignments that insurance against it is not really necessary. The cost of the packing is 30 per cent. above that of ordinary heavy cases.

Canadian manufacturers of electroplate are invited to furnish the Department of Trade and Commerce, Ottawa, with catalogues, prices and full particulars of their goods. Prices should be on the basis of f.o.b. steamer at Montreal, St. John or New York, as importers find it difficult to ascertain Canadian inland charges at this end.

It is stated that some time prior to the war there was some Canadian plate on the Australian market which was looked upon as exceptionally fine in quality and design, and that a renewal of supplies from the same source would be welcomed.

At the present time the United States and Japan are mostly supplying the demand, but dealers are desirous of having the opportunity to purchase elsewhere and would therefore give Canadian goods a favorable reception.

AUSTRALIA OPENS BIG FIELD FOR TRADE

St. John, N.B., Firm Shipping in Good Quantities to Melbourne and Sydney

English manufacturers have, until just very recently, enjoyed the bulk of trade entering into the ports of Australia, probably on account of the close business relationship existing between the two countries and of the similarity of trade conditions, currency, etc., and it has been rather a hard proposition for Canadians to break into this field. Nine cases out of ten Australian buyers looking outside of their own country for material mailed their orders to firms in the British Isles, while the balance of business probably went 50-50 to United States and Europe.

The Canadian Trade Commission is reporting a considerable amount of material being booked up by Canadian manufacturers for shipment to this market, which is the direct result of "After-the-War" trade drives, and which shows that they (the manufacturers), are able to compete successfully with other countries there.

Messrs. T. McAvity & Son, Ltd., of St. John, N.B., are one of the Canadian firms who have established a business connection in the Commonwealth, and they are making, and have made, many large consignments of brass valves, steam cocks and steam fittings, etc., to firms in Melbourne and Sydney, who, in turn, are placing the goods on the market. The buyers demand goods of first class material and manufacture, and everything to strict specification. A direct steamship line between St. John and Melbourne is a feature which facilitates shipping done by the firm to that port and their location, in Canada's winter port, from which direct lines of steamers ply to England, France, West Indies, etc., affords them an excellent opportunity and a decided advantage over others in developing export trade generally.

As outlined in last month's CANADIAN MACHINERY, "McAvitys" are also carrying on an extensive trade with the Old Country, having Lieut.-Col. T. Malcolm McAvity on the ground there in their interest. A branch office and warehouse will be opened in London in his charge shortly, where a stock of the firm's manufactures will be carried for the use of the English trade.

B. C. Saunders, who recently resigned his position as sales manager of the Wilmarth & Morman Co., has purchased an interest in the Grand Rapids Grinding Machine Co., and becomes associated with that firm in the active management of the business. At the annual meeting just held he was elected secretary and sales manager.

GETS APPOINTMENT AS TRADE AGENT

Capt. Edwards to Represent British Interests in the Dominion

Captain Evan J. Edwards has been appointed to act in the Senior Trade Commissioner post of Canada at Montreal, vice Mr. G. T. Milne, O.B.E., who has been appointed Commercial Secretary to the British Legation in Cuba.

Captain Edwards has had a large and varied business experience in various parts of the British Empire, recently holding the post of Manager of Sales (Home and Export), for a large manufacturing firm in the United Kingdom. During the war he served in the Royal Naval Volunteer Reserve in home and foreign waters, and later was appointed Admiralty Overseer in an airship works in the North of England.

For several weeks he has been busy at the Department of Overseas Trade, making himself conversant with the general conditions in Canada and the methods by which he will apply his past experience to this work. Captain Edwards is leaving England immediately to take up his duties at Montreal.

FARM IMPLEMENTS SHORT IN RUSSIA

High Prices Paid For Anything That Looks Like an Agricultural Machine

Canadian agricultural engineers, who had developed a considerable market in Russia before the war, should find ample scope there when the country was settled down again to sober business. It is a noteworthy fact that Russia possesses no large factories for making agricultural machines and implements. Even scythes are not made in Russia. The ordinary plough with one share is made in two factories—one in Riga and one in Kharkof. The attempt made by the locomotive works at Kharkof to manufacture other agricultural implements is stated to have proved a total failure, in spite of the large sums of money that were spent. When the war broke out wholesalers were quickly cleared of what stocks they had, and domestic production ceased. Even the locomotive works at Kharkof turned its plant for making agricultural tools into a munition factory. During the revolution much of the equipment of the large estates was destroyed, and, in short, Russia now faces a total lack of farm implements. How great this lack is may be seen from the fact, stated in a Dutch contemporary, that in the summer of 1918 150 roubles apiece was paid for ordinary scythes, and even broken or blunted scythes were sold for 75 to 90 roubles apiece.

Manufacturing Washers is a Special Study

On the Assumption That Washers Should be Perfect, This Concern Has Made a Special Study of Their Business. Nothing But Washers Are Made in the Plant About to be Described

By J. H. MOORE

A LITTLE Irish lad was passing, or at least attempting to pass his examination, when he came to a question that sadly puzzled him. Here was the question: "What is a washer, and what are washers used for?" Scratching his tousled head, he suddenly had an inspiration, and wrote the following: "A washer is a piece of iron or steel with a hole in it, and they are used for everything."

Granted that technically he was rather off in his description, yet he wasn't so far from the mark, for washers are in reality made in almost every conceivable shape, and have without question a hole in them. The uses to which they can be put are innumerable, although one would hardly like to say they were used for everything.

Leaving the Irish lad to his own answer, here is how the Union Iron & Metal Co., Ltd., Toronto, came to make nothing else but washers.

During the war this concern was busily engaged in the manufacture of shrapnel shells. On the cessation of hostilities, they looked around them for a commodity that they could manufacture, yet feel sure that the demand for such a product as they would decide upon would continue. After considerable discussion the product that was decided upon spelt WASHERS. It was figured out in this way that a washer was always a washer, no matter where you went. Britain had its standard bolts, and certain standard threads, V-threads, Whitworth, etc., while other countries had their particular standards, but a washer was standard for any of these different bolts. In other words, a washer is a washer the world over.

FIG. 2—THIS COMPLETE LINE OF AUTOMATIC PRESSES HANDLE THE SMALLER SIZE WASHERS.

Having made up their mind on this point, the next step was to concentrate on the problem of rapid production with guaranteed quality. As Mr. O'Brien, the manager of the concern, stated to the writer, "We felt that while production was a big item in our program, quality was something bigger. First, let us convince the trade that we intend producing and delivering only first quality washers, and the rest will come easy was our slogan."

The advisability of this plan has proved itself without doubt, for the writer personally saw washers that were so far ahead of the average style, as to merit not being spoken of in the same breath.

FIG. 1—THE ROLLING OF STOCK TO THE PROPER GAUGE.

A washer, to be a good washer, should be flat, without burrs, and the hole should be in a central position. This description will, no doubt, bring to readers' minds, some washers they have seen that did not fit in with these qualifications, so that although we said a short time ago that a washer is a washer the world over, we might safely add, "There are Washers—and Washers."

In starting this industry, they made the same mistake as many others, namely, that they started by constructing gang dies for rapid production. These dies were arranged so that a quantity of washers were punched out at one time, certain punches performing the function of piercing the centre hole, while the others were blanking the outside diameter. Not only was this plan a costly one as regards die and punch upkeep, but it was very unsatisfactory from a quality standpoint, as the washers came out distorted and with a very dished appearance.

After quite a discussion, it was de-

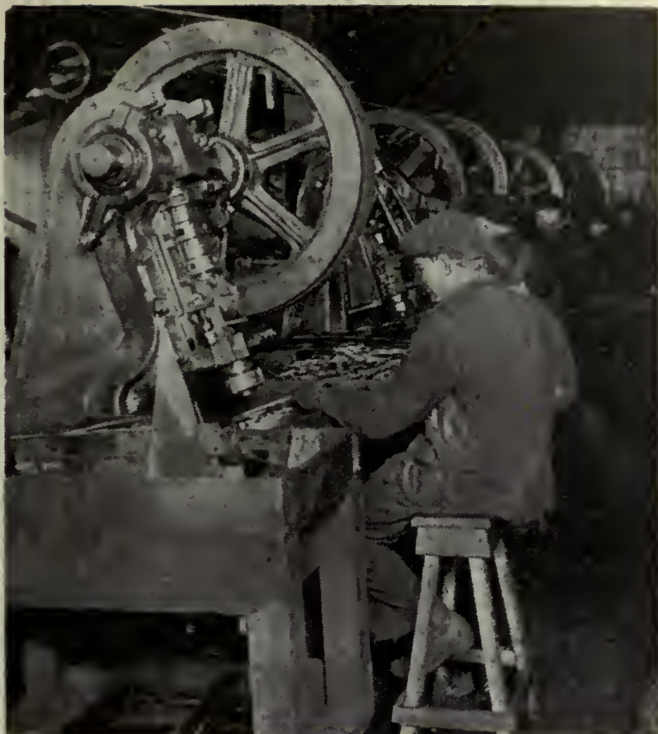


FIG. 3—A LINE OF HEAVIER PRESSES THAN SHOWN AT FIG. 2.

cided to scrap these gang dies and go after the problems from an entirely different angle. It was arranged that only one washer would be produced at a time, and that the piercing of the centre hole, and the blanking of the outside diameter would take place on the same stroke of the press.

This was done, and results have far exceeded the most sanguine expectations. Not only do the washers come out perfectly flat, but as the centre hole piercing and blanking operation occur at the same time, the hole cannot help but be concentric with the outside diameter. In this way they have produced a perfect washer. Let us enter into the actual making of the washers from the time the plate is delivered to the storage yard.

The Rolling Operation

The stock is first cut to proper widths on a huge shear of 36 inches capacity. This machine ranks with the largest in Canada, weighs approximately 27,000 lbs., and can cut up to 6½ round bars. It is driven direct from a 50 h.p. motor, and cost over $10,000 to install.

After shearing, the stock is trucked to the plant. Should the material be of the proper gauge, it goes directly to the press room, but in the event of some gauge be required that is not in stock, they proceed to roll their own material. At Fig. 1, we show these rolls in operation, installation being from the Toledo Machine & Tool Co.

Six men work in conjunction on this operation in the following capacity:

The stock is placed in a Strong, Carlyle & Hammond furnace, and heated to 1,300 degrees Fah., the fuel used being crude oil. The operator attending to the furnace pulls the stock partially out of furnace, while one of the two men stationed at front of machine take the stock on tongs, and pass it through the rolls. The reason two men are used at this position is to guarantee the running of rolls to full capacity.

Referring to the picture, we see a worker stationed at side of rolls operating the thickness dial. As a rule, two passes, or three to four at the most, are sufficient, but of course the number of passes depends on the amount which the material has to be reduced. The dial operator is thoroughly conversant with these conditions, and regulates the rolls as each pass takes place.

The Press Room

The next operation in sequence is that of the stamping of the washers. This work is done on a variety of presses. Fig. 2 illustrates a line of Niagara Automatic Presses, while Fig. 3 shows a batch of heavier presses of different makes. As explained previously, this concern has adopted the principle of one washer for every stroke of the press. They accomplish this in the following manner. The dies are constructed on the sectional plan, that is, the dies are made up of various pieces or sections. Suppose we had to punch some washers two inch diameter with a ½ inch hole. The outside die would be a two-inch blanking die, while the centre die would be a ½ inch piercing die. The ram of press would be equipped with two punches, a ½ inch punch and a 2 inch blanking punch. Readers will, no doubt, follow this description, so we will go one step further. Suppose another washer is required, 2½ inch diameter with a ½ inch hole as before. In this case, the centre punch and die are not disturbed, but only the 2 inch die and punch removed. The 2½ inch size is placed in position, and away the production goes without any lengthy interruption. Every die is standard as far as fitting the bolster is concerned, so that this sectional die proposition is not only economical, but ideal from a quick changing point of view as well.

Rumbling the Washers

When a sufficient quantity of washers have been punched, they are placed in rumblers, as shown at Fig. 4, and revolved in this machine for one hour or more. This operation polishes the washers, besides removing all burrs. In coming out of these barrels, they are transferred to the packing and storage department.

This department employs a simple and efficient scheme for handling standard lines. The photo at Fig. 5 illustrates the idea clearly. The storage benches are so arranged that each size washer has a certain compartment. On the wall above this section is plainly

FIG. 4—REMOVING THE RUMBLED WASHERS.

marked the size washers contained in each bin. These bins are equipped with a sliding door which on being pulled up allows the washers to come down into the box, as shown in packer's hand. The benches are built on a slight slope to aid in the removal of the washers. They are next packed in two ways, in boxes of 50 lbs. and in kegs of 150 lbs.

To mention how many types of washers this concern makes would be impossible, for as they say themselves, show us the style washer you require and we will make it. The safest way to state their present range would be to say any old size and shape from No. 30 gauge stock to as high as ⅝ inch thick.

Leaving the washers packed ready for shipment, let us consider various ideas adopted by this concern that are worthy of attention.

Item of Interest

For certain classes of washers, they use what is termed scrap plate. This plate, although called scrap, is in reality new material. It is composed of scrap pieces of plate used for innumerable other purposes. This plate is bought up and brought in from all parts of America and Canada, and to give readers an idea of its general appearance, we have photographed a pile of the material as it arrives at the plant. It is used just as shown (that is if of proper gauge) and whatever scrap is left over does not really amount to anything.

All scrap from any stock or plate is placed in a baling machine. No wires are used for baling purposes, but the material is compressed into bale form. This baled material is returned directly to the mills.

A close tab is kept on all stock used, and everything is carefully weighed in order to keep track of material passing through their hands.

FIG. 6—WHILE THIS LOOKS LIKE A JUNK HEAP IT IS A COLLECTION OF SCRAP ENDS OF FIRST-CLASS PLATE.

In the packing room, a large blackboard is installed. This board is arranged with certain spaces covering all their standard sizes of washers from 3/16 inch to 2⅛. Opposite the various sizes is marked the number of boxes of washers in stock. By glancing at this board, anyone can immediately tell what stock is on hand.

Some Examples of Special Washers

"Can you give us information of any special washer that saved considerable money to the firms ordering it?" we asked, and here is the story as told to us.

A certain automobile firm was desirous of obtaining a special washer made from cold-rolled stock. The washer was 4½ inch diameter, 2⅞ inch hole, ⅛ inch thick, and it was essential that the washer be absolutely flat to within two-thousandths of an inch. We produced and delivered at a cost of 21 cents each.

FIG. 5—THE TYPE OF STORAGE BINS USED.

The previous method of production was an extremely expensive one as the following operations will show: The washers were turned from the solid on the lathe, and the highest production was 20 washers every ten hours or an equivalent to two per hour. Not considering material at all, and figuring labor at 75 cents per hour, we have a cost of 37½ cents per washer. On top of this figure, you must add, not only material cost, but the upkeep on a machine tool worth in the neighborhood of two or three thousand dollars.

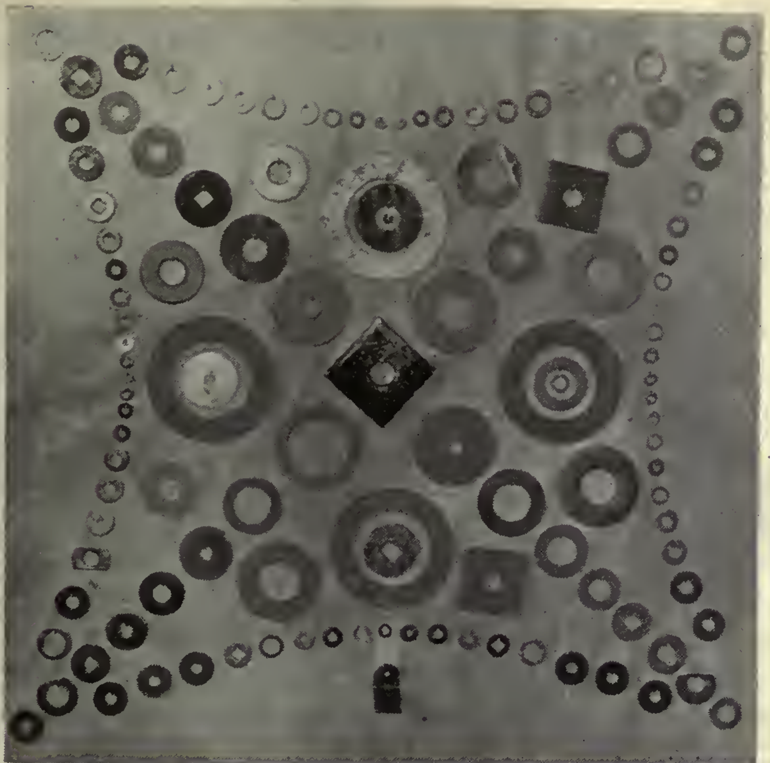
Another notable example that came to our attention was a case of quick service de luxe. A certain firm had a large quantity of angle iron which had become useless for its original purpose owing to a change in plans. They hated to scrap this material, and as they required a large quantity of washers in a hurry, they got in touch with the concern whose plant we have described.

The result was that the angle iron was sent to this firm at 10 o'clock in the morning, and the washers finished and delivered by 4 in the same afternoon. Some hustling. Here is how it was done:

The angles were first rolled out flat, then sent directly to the press room. Work was commenced immediately, everyone co-operating in the rush. Needless to say, they are proud of this record as they have good cause to be. Our reason for retelling the tale is to illustrate how far real service can be carried out.

Production Costs

Believing that they should know exactly to a decimal portion of a cent what their various lines are costing them, this firm has different cost charts, graphs, etc., which show clearly these expenses. The charts are so arranged to show a



—THIS PICTURE GIVES SOME IDEA OF THE RANGE OF WASHERS MANUFACTURED.

week's production. Naturally, if the costs go up or down the cause is fully investigated.

The cost report is divided into certain headings which are well worth mentioning. First comes the size of washer, inside hole, and outside diameter. Next in sequence comes the gauge, pounds produced, scrap percentage, labor cost per pound, material cost per pound, direct overhead cost per pound, and ideal selling price. The last item is figured in the following manner: They figure approximately the overhead cost, then add a reasonable profit to this figure. By totalling the labor and material cost to this figure, they arrive at an ideal selling price. Nothing is left to chance but the entire business is run in an honest, common-sense basis.

Although they have only been making washers since June, 1919, a production of 1,000 tons a year has been attained. When we state that there are 64,000 washers in 100 pounds of small-sized washers, one can readily see the quantity necessary for 1,000 tons of washers. Of course, all washers are not so small, therefore, have less quantity per thousand pounds.

It is the intention of this concern to go after the world's market, but up to date it has had all it can do to cope with local demands, so that we can safely conclude by remarking that they surely picked on a commodity that was ever in demand, when they decided to specialize on washers.

INTERESTING DATA ON FUSIBLE METALS

Many times a person will want to make a cast or die in metal for use in embossing a token for Christmas or as a present, and for this and many other purposes the fusible metals are convenient on account of their low melting point. Some of them melt at even a lower temperature than is required to boil water.

Type metals, although they do not melt at very low temperature, are much preferable where a clean, sharp and fairly durable cast is wanted.

In order to mix and use these metals intelligently one should know something about their properties, especially those of antimony, bismuth and tin. Antimony and bismuth, each in their own way, have a marked effect upon any alloy with which they are incorporated. Antimony is very brittle; it also has the property of expanding when it solidifies; and, best of all, it imparts this property to its alloys, thus making them give fine, sharp castings.

Bismuth is very brittle; it forms alloys with other metals readily, and also imparts to them hardness and fusibility. In other words, it makes them melt at a lower temperature than they alone would melt. Most fusible metals contain bismuth.

Tin, when used with antimony, gives toughness and tenacity, and removes the brittleness caused by the antimony. Some formulas for the most common fusible metals are as follows:

1. Wood's metal—Bismuth, 4 parts; lead, 2 parts; tin, 1 part; and cadmium, 1 part. Melts at about 149 degrees F.

2. Fusible metal—Lead, 1 part; tin, 1 part; and bismuth, 2 parts. Melts at about 190 degrees.

3. Fusible metal—Bismuth, 8 parts; lead, 5 parts; and tin, 3 parts. Melts at about 200 degrees.

4. A tough type metal—Lead, 5 parts; antimony, 2 parts; and tin, 1 part.

5. Ordinary type metal—Lead, 5 parts; antimony, 1 part; and tin, ½ part.

By adding more lead in these type metals a softer alloy will be obtained. Some other useful formulas are as follows:

6. Stereotype metal—Lead, 5 parts; antimony, 1 part; and tin, ¼ part.

7. Non-friction metal—Tin, 10 parts; antimony, 1 part; copper, 1-5 part.

8. A German silver metal for casting —Copper, 2 parts; zinc, 1 part; and nickel, 1 part.

9. Pewter—Tin, 6¼ parts; antimony, 1 1-16 parts.

For the convenience of those who wish to use any of the foregoing formulas, the following table may be of use to determine the melting points. The degrees are Fahrenheit, and are the ones accepted by the United States Bureau of Standards.

Wrought iron	melts	at	2,737	degrees.
Copper	"	"	1,981	"
Bronze	"	"	1,692	"
Antimony	"	"	1,166	"
Tin	"	"	450	"
Bismuth	"	"	520	"
Cadmium	"	"	610	"
Lead	"	"	621	"
Zinc	"	"	740	"

Want Canadian Lines.—"The British firm of Albert Moloney & Co., 12 Amargura Street, Havana, Cuba, are anxious to obtain sole agencies in Cuba for the following heavy machinery manufactured in Canada: Return Tubular Boilers, Water-tube Boilers, Condensers (surface, jet and barometric), Power Pumps of all types (steam driven, motor and belted), Vacuum Pumps, Steam Engines, Valves and Fittings, Electrical Generators and Motors. Canadian manufacturers must bear in mind that Americans enjoy a preferential tariff in Cuba, but that this is more than offset at the present time by the discount on the Canadian dollar. Another substantial assistance to Canadian trade with Cuba is the recent establishment of a direct line of the Canadian Government Merchant Marine between Cuban ports and Havana."

Jones—that is not his name, but it will do—had the misfortune to get in the way of an automobile driven by a lady on Van Ness Avenue, and was taken to a hospital; but his injuries were not serious, so he was immediately removed to the police station, where his assailant was being held. And as soon as Jones got there the lady started in to impress him with the fact that blame for the accident was all his.

"You know, M. Jones," she said, "you must have been walking very carelessly. I am a very careful driver. I have been driving a car for seven years."

"You've got nothing on me, ma'am," said Jones, politely. "I've been walking for thirty-four years."

Machine Design in Manufacturing Practice

The Subject of Design, From Both a Functional and Manufacturing Standpoint is Taken Up. This Article Should Interest Tool Designers, Superintendents, Foremen and Workmen Alike

By E. BUCKINGHAM

IN early days the design of a new mechanism existed only in the mind of the mechanic engaged in its construction. It was made piece by piece, each detail taking definite shape as it was constructed. The original mechanism was completed, tested, and corrected or rebuilt before the design was finished. Duplicate mechanisms that might be constructed were patterned after the original, and modified or improved as suited the ideas of the mechanics who performed the actual work. Needless to say, interchangeability and quantity production were non-existent factors.

Sketches and drawings were next employed to express the ideas of the inventor, but little attempt was made to indicate more than the general idea and construction. The details of the design and the dimensions of the individual parts were matters for the workmen to decide. A competent mechanic was required to determine these for himself. It was part of his training. Details and dimensions, more or less complete and consistent, made their appearance on the drawings later. Errors and omissions were of little moment, as the mechanic who worked to the drawings expected to select and use the proper information given and to ignore the incorrect, supplying all omissions from his own store of mechanical knowledge and experience. The quantity of production was small. Little or no importance was placed on interchangeability. A few workmen thoroughly acquainted with the requirements of the mechanism or with the intentions of the designer performed all the actual work of construction. Under these conditions functional drawings, which make no pretence of giving more than the general construction or combination of mechanical movements and the general outline of the detailed parts, are sufficient.

Under present manufacturing conditions, with productive operations subdivided into elementary tasks, with productive labor trained along specialized lines, with productive equipment specialized and more nearly complete, with the rate of production greatly increased, with larger organizations in which but few individuals are thoroughly conversant with all the detailed requirements of the mechanism, the design must cover a wider field and be much more comprehensive and accurate. In addition to epresxsing the ideas of the inventor it must supply most of the knowledge and experience formerly brought to this work by the mechanic.

We now have, therefore, two types of designing to consider, which we will call the functional design and the manufacturing design. The manufacturing design is a detailed development of the functional design. It corrects and modifies the functional design where necessary to facilitate the economical production of the mechanism, giving as much as possible of the information previously supplied by the workman. It is evident that the manufacturing design will always be incomplete to a certain extent. Suitable provision for its modification must be made to obtain the advantage of the new and improved methods of manufacture which are constantly developed. Changes, however, in proved manufacturing designs should be avoided when possible. As much or greater care should be taken in adopting changes as is exercised in establishing the original manufacturing design. After equipment has been completed, changes are very costly. A change which might be justified in the early stages of work often costs more than it is worth in the later stages. This makes it of the utmost importance that great care be exercised in the development of the original manufacturing design of a new commodity which is to be manufactured in large quantities on an interchangeable basis.

For the construction of a small number of special machines, or tools and fixtures, which are built in a general machine shop or toolroom, the functional design is all that is required. The number of men engaged in the production is small, their training is general, and the requirements of the mechanisms can be explained to them personally by the designer as questions arise; therefore, the additional expense of a manufacturing design is not justified. However, in the manufacture of a large quantity of any article, particularly if interchangeability is sought, a complete manufacturing design is necessary. True, this design will work itself out in practice in the course of time, but this is a very slow and expensive method. It means that experimental work on a large scale is carried on, whereas it can be done on a smaller scale with better and speedier results. Furthermore, this method results in continual alterations in the equipment and a loss of interchangeability. However, this article is not concerned with designs of special mechanisms, tools, fixtures, etc.; attention will here be given to the requirements of designing as applied to the manufacture of a product in large quantities.

In both types of designing the end in view is the same as far as the functioning of the mechanism is concerned. This is to develop a product capable of performing certain results of which will fill or create a public demand for itself. The means of attaining this are governed by various considerations. For the functional design, any solution is satisfactory. As regards the manufacturing design, the methods adopted must result in ultimate economy. Also, the manufacturing design must resemble the functional to such an extent that all patents will be retained, while those of competitors must not be infringed. This is one of the commercial difficulties that at times prevent the true economic development of a commodity.

It is plain that the manufacturing designer must take into consideration every circumstance involved in the production of the commodity. To be successful he must work in close co-operation with all who will be engaged in the development and operation of the manufacturing equipment. This will include the tool designers, and the superintendents and foremen of the various manufacturing and assembling departments. In general, there is too much detail involved for any one person to carry it alone to a successful completion.

When considering the manufacture of a new product, one of two conditions usually obtains. Either it is to be produced in an established plant with an existing variety of manufacturing equipment, or a new plant must be created. In the first case the designer must be familiar with the available equipment, and must modify the functional design so as to utilize these facilities to the best advantage. In the second case he is not restricted to the use of any specified equipment. In either case, unless the volume of production is to be extremely large with many automatic operations, every effort must be made to reduce the machined surfaces of the various components to simple, elementary surfaces, which can be readily machined on standard machine tools with simple, rugged, and inexpensive tools, jigs, and fixtures. If, in the manufacturing design, the component parts are thus simplified, a further advantage is gained. The productive operations on these parts are resolved into simple, elementary tasks, and this simplifies the problem of securing and training the necessary productive labor. Simplicity is a primary source of economy. The number of machining operations is reduced and the direct labor cost thereby lowered. The amount of time that raw material is tied up in process of manufacture is reduced, and quicker returns are secured on the money invested in direct labor and materials. The many other economies resulting from simplicity in design, such as lower equipment and maintenance costs, are obvious.

Those responsible for the manufacturing design must pay close attention to the character of the materials they specify for the individual components. Ultimate economy is the desired end. This is affected by many different and sometimes opposing factors. The first cost of the material is one of these. When several thousand duplicate mechanisms are manufactured, the slightest saving in the cost of direct materials is multiplied over and over again in the course of time. As many parts as possible should be made of the same size and kind of material. This permits purchasing in larger quantities, and reduces the gross amount of raw material carried in the storeroom. As far as possible this material should be of standard sizes and forms that can be purchased in the open market at the lowest prices.

Due consideration must be given to the possible sources of supply for the materials specified. It is a serious matter when production is held up because of lack of material, which has a limited or uncertain source of supply. Every effort must be put forth in making the manufacturing design to specify materials which are readily secured.

The actual economy of low-priced material is governed by the ease with which it can be machined. If a part requires many machining operations, a low initial cost for material is often overbalanced by the greater cost of manufacture. Therefore, if a more expensive material can be machined at a lower cost, ultimate economy dictates its purchase. For this reason, the use of extruded or rolled bars of special form is often adopted in the manufacture of small parts for adding-machines, typewriters, counters, and other similar mechanisms.

An illustration of this point occurred in a large plant which makes small duplicate parts. Several of these parts were made of brass castings because of the lower cost of machining, but the price of copper began to rise and was soon about double its normal price. It was decided to substitute cast iron for brass, because the difference in the cost of machining was less than the difference in the market price of the materials. Luckily, an investigation was made before the change went into effect. This plant had its own brass foundry, but no iron foundry. It was discovered that the foundry had purchased no copper for several years. In fact, a large stock of pig copper had been stored in a shed and was never touched. Another department of this plant was engaged in making copper matrices by a plating process, and the trimmings from these supplied all the pure copper which the foundry required. This, with scrap brass stock from other departments, made it unnecessary to purchase any metal for the brass foundry in the open market. Needless to say, no change was made in the material of the castings. This incident indicates in some degree the many factors that must be considered to secure genuine economy. It is not a matter of mere addition and subtraction; every existing condition must be taken into account.

Whenever the weight of a commodity is an important consideration, as with automobiles, etc., the materials used in making it must be of a better grade than when the weight is less important. In every case the materials specified must be sufficiently strong and rigid to hold their form throughout the normal life of the mechanism. Thus, the detailed design of the various components is governed to a great extent by the nature of the materials which are used in their manufacture. For example, if forged steel is substituted for cast iron, the component will be of much lighter design.

The composition of the materials used is governed by the nature of the service which the part must render. One that is subjected to excessive wear must be made of material hard or tough enough to withstand it. Material for parts liable to corrosion or other chemical action must be of the proper composition to counteract it. Material for parts under constant vibration must not crystallize readily. In every event the materials must be selected to withstand both the use and abuse which they will eventually meet.

The establishment of suitable clearances and tolerances is a vital, if not the most vital, factor in the manufacturing design. Tolerances are, in many respects, like laws. There are two classes of laws. One is so severe and exacting in its nature that it cannot be enforced, and soon falls into disrepute and is disregarded, even though it remains on the Statute Book. The other is drawn up with a full understanding of existing conditions, and its justice to all concerned is so evident that it is readily and consistently enforced.

Similarly, tolerances fall into two classes. Those which represent the extreme conditions of accuracy obtainable from the equipment under ideal conditions can be specified without regard to the functional requirements of the product. In such cases they, too, soon fall into disrepute and are disregarded, even though they still remain on the drawings. On the other hand, tolerances are readily and consistently maintained when they represent the widest variations that the functioning of the mechanism will safely permit.

Liberal tolerances and clearances result in easier manufacturing conditions of every sort, and thus promote economy; they make quantity production possible. The serviceable life of tools depends directly on the extent of the tolerances. Every exacting tolerance is a direct check on the economical and rapid production of the mechanism. On the other hand, if the functional requirements do not permit wide tolerances, the functional requirements must prevail.

It is evident, then, that the construction must be carefully studied so that the manufacturing design will permit the widest possible tolerances. It is only in exceptional cases that a mechanism cannot be modified so as to retain all functional advantages and yet allow liberal tolerances on the majority of its dimensions. Very often, when there is a severe functional requirement to maintain, the introduction of simple means of adjustment promotes easier manufacturing conditions. In other cases a system of selective assembly is more desirable.

The designer must determine which parts will be interchangeable. Interchangeability can be carried too far, and thus allowed to defeat its own purpose, as noted in a previous article. Interchangeability and liberal maximum clearances are closely connected. Whenever reasonable clearances are out of the question on certain components, these parts are not suitable ones to be manufactured on an interchangeable basis. In this matter the relative accuracy of the available equipment plays a large part. For example, if the surfaces are elementary and can be finished by a simple grinding operation, much closer tolerances can be economically maintained than if they are composite and require milling or turning operations. The variations on work finished by grinding are about one-third those resulting from milling or one-half those from turning; and the effort expended is no greater. On the other hand, grinding is not always suitable or possible. Therefore, in determining whether or not certain required conditions permit reasonable tolerances, the designer must consider possible methods of manufacture and be well informed as to the normal variations resulting from them in actual practice. This knowledge is the outcome of experience in checking and analyzing results previous secured. This is a matter to which little attention has been paid in the past. For example, in a large and long-established plant, where many milling operations are performed, it had been assumed that these operations were maintained within a tolerance of 0.001 in. Actual measurements brought out the fact that the normal variation was over three times as great as that, and always had been. A similar misconception of actual conditions was apparent in the majority of shops engaged in Government work during the recent war. When their product was actually checked by limit gauges and held to the specified tolerances, a variation of 0.002 in. or 0.003 in. was found to be an extremely small manufacturing tolerance. It is, therefore, one of the duties of the maker of the manufacturing design to specify the parts which are to be made interchangeable, those to be selectively assembled, and those to be fitted to each other. Careful attention to this detail saves much wasted effort in the shops subsequently.

Almost every mechanism can be subdivided into smaller units, which are distinct in their purpose. For example, an automobile contains an engine, transmission, axle, drive, carburetter, magneto, etc., which are assembled and tested as units and later assembled into the completed car. In like manner a typewriter is subdivided into the carriage, the escapement, the type-bar, and the segment assembly, etc. The assembly is greatly facilitated if the design of the mechanism permits such unit assembly construction; and efforts should be made to obtain this result whenever practicable.

There are many other advantages of this unit assembly construction. Not only the various manufacturing departments of one factory, but also entire plants, are specializing more and more. The automobile has hastened this trend more than any other one thing. Where such unit assemblies are of equal value on several articles, separate plants spring up to produce them as a specialty. This gives the benefits of quantity production where otherwise they would not exist. Therefore, we have as a direct result of unit assembly construction, separate plants specializing in engines, rear axles, carburetters, magnetos, etc., for automobiles; ball and roller bearings for all types of machinery; and many other similar specialized products.

Another practice which allows the benefits of quantity production to be obtained in the production of smaller number of complete mechanisms is the standardization of many of the individual components. For example, most manufacturing concerns have standardized their screws, nuts, studs, rivets, and other small parts. The majority of machine-tool builders also standardize their handwheels, micrometer thimbles, gears, toolholders, work-arbors, etc. A good illustration of the economy of this practice is found in the experience of one plant which originally manufactured over one hundred and fifty special screws and studs for its particular product. Little effort was required to reduce this number to less than half, thus increasing the rate of production of these parts and also reducing the stock of spare parts. This practice is extending to larger and more important components. Not only are similar parts produced by individual plants being standardized, but parts used in common by several manufacturers are also standardized and often manufactured as specialties by other concerns.

The design must permit the ready assembly of the product. Parts which require attention in service must be accessible. Attention to these details reduces assembling and service costs, and these must be considered to ensure ultimate economy.

The service requirements are the most difficult to determine. Time alone brings the desired information. Experiments and endurance tests in the factory are insufficient to give it. After a mechanism is on the market, it receives use and abuse that the makers never dreamed of. Yet if the product fails under these unforeseen conditions, the manufacturing plant is blamed. Naturally, the nature of the commodity determines what sort of service it must render. The service requirements of an automobile are distinct from those of a typewriter; those of a precision machine tool—which is supposedly used by skilled mechanics only—differ from those of a lawn-mower, etc.

The service requirements include the protection of the working parts from dirt and other foreign matter, the provision of proper lubricating facilities, and the protection of the operator from moving parts. The question of the best preservative finishes, such as japanning, plating, painting, etc., must also be answered to meet the service requirements, both of use and appearance. For these and many other similar problems a solution is sought that will result in the maximum amount of service at a minimum expense.

It should be clearly understood that the manufacturing design is not undertaken with the idea of wilfully altering the functional design, but is made to facilitate manufacture and to furnish as much as possible of that vast amount of detailed information previously brought to the productive work by the mechanic who carried out the inventor's ideas. The alterations made in the functional design by the manufacturing design should not be looked on as any criticism of the original lay-out. Each has its distinct purpose to perform. Many large plants recognize clearly the difference between the two types of designing and maintain separate departments for each. The original research and inventive work is carried on independently of the factory operations. New or improved designs are turned over to the factory organization, where they are redesigned to meet the manufacturing and service needs.

SOME SHOP SYNONYMS

We read in a recent issue of "Link" (which is the house magazine of the Coventry Chain Co., Ltd.), a few shop synonyms well worth repeating. Here they are:

A synonym, as is well known, is to be defined as a word we use when we cannot spell the other one. Considering the intricacies of English orthography, this is a highly satisfactory justification of the existence of the synonym, and we are far from having any grievance against it. However, we do not advance the theory that synonyms were instituted as a convenience in spelling. No doubt, like Topsy, they "just growed," and that, in common with language in general. Anyway, like the poor, they are with us, and as we are not concerned here with the question of origins we will proceed to mention a few examples of workshop synonyms.

If we mention that "guessing stick" is a common synonym for a slide rule, it is not intended as any reflection on the drawing office.

The sine bar is often termed a side car, but for such a respectable tool, that is merely flippant. To speak of juice is a rather irreverent way of referring to electricity, and to call an oil separator a whizz is a primitive use of language.

The question of the connection between E. treatment and heat treatment of steel would perhaps be better referred to in the "Things we want to know" column; but anyway, it is not quite as mysterious as it may seem.

Certainly such a pretentious adjective as hermaphrodite would never be allowed to wander about the shop unmolested, and accordingly calipers of that description become a "pair of Jennys," which is a deal more homely.

It might be expected that the war would leave some mark on shop terms, and so we hear double angle plates or U plates referred to as U boats.

No doubt it was originally intended that there should be some difference between adjustable spanners and micrometers, but even in the best of shops, tools and terms alike sometimes get confused. One would hardly take plug gauge to be a synonym for broach, but we know of an occasion when a large plug gauge was so used, and it was only given up when it was reluctantly admitted that "there was no more cut left on it."

It is estimated that the Irish bogs contain between 3,500,000,000 and 4,000,000,000 tons of anhydrous peat, or 5,000,000,000 tons of air-dried peat. At present about 6,000,000 tons of peat are burned as fuel in Ireland per annum, and over 4,500,000 tons of coal are imported. If this coal were replaced by peat fuel at the rate of 2 tons of air-dried peat to 1 ton of coal, the total consumption of peat in Ireland would be about 15,000,000 tons per annum, and the peat deposits would be sufficient to satisfy the fuel and power requirements of the country at the present rate of consumption for more than 300 years.

The doctor was attending an injured woman who had come to his surgery with her arm severely bitten. As he dressed the wound he remarked:

"I cannot quite make out what sort of animal bit you. The wound is too small for a horse's bite, and too big for a dog's."

"Oh, it wasn't an animal!" exclaimed the patient. "It was another lady."

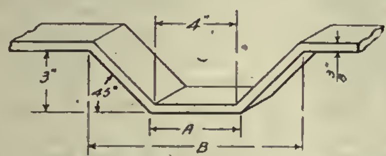
Shop Arithmetic, Continuation of Taper Work

Fifteenth of a Series in Practical Mathematics for the Mechanic and Those Learning the Machinist Trade—The Present Article Goes Still Further Into the Subject of Taper Work

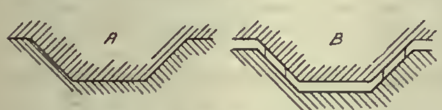
By J. H. RODGERS

IN our treatment of taper work in a previous lesson, the examples were confined almost entirely to circular work produced in the lathe. While the fundamental principles are identical, no matter how the taper is produced, the method of solution frequently requires some mental research on the part of the student or the mechanic doing the work.

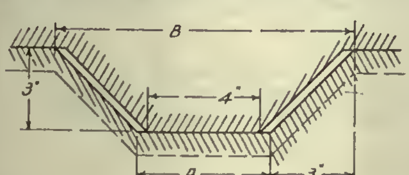
Suppose a punch and die is to be made to form a piece as shown below, made from ⅜ inch by 2 inch strip.



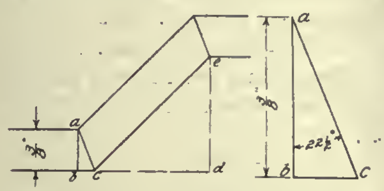
From the dimensions given the tools are to be made. It will readily be seen that the width across the nose of the punch will be 4 inches, and the sides inclined at an angle of 45 degrees. We have the depth of the die—3 inches, so the problem is to find the dimensions A and B. Without previous experience on work of this character a workman would probably make the punch and then fit the die to it. If templates are used he would make one to fit the punch and another to fit the one first made without considering the stock to be bent, thinking that if the punch is raised the thickness of the stock (⅜ inch) that all would be well. However, let us make a line template of the shape required and see the result. Here it is:



The sketch A shows the male and female templates fitted face to face. At B they are separated ⅜ of an inch. It will be noted that the horizontal spaces, equalling ⅜ inch, are wider than the inclined spaces, and the light vertical lines will make the reason quite obvious. It is evident that the space must be uniform throughout. The corrected templates, therefore, would appear as below, when allowing for the stock.



To find width A for the bottom of the die, we must have recourse to the rules on the solution of right triangles, in other words, an application of "trig." To aid the reader in the calculations the sketch below is given.



From the rules of trigonometry the side opposite (b-c) equals the side adjacent (a-b) multiplied by the tangent of the angle. In a formula this would be:

$$(b-c) = (a-b) \times \text{tangent } 22\tfrac{1}{2}^{\circ} \text{ or}$$
$$(b-c) = .375 \times .4142 = .155 \text{ inch}$$

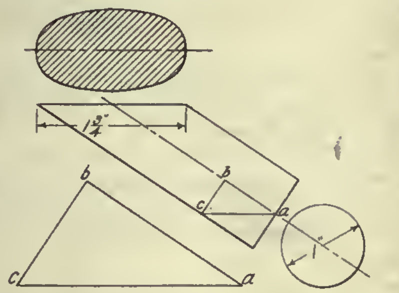
The width of A then would be: ...

$$4 + (2 \times .155) = 4.310 \text{ inches}$$

In the study of right triangles we have seen that, when the two acute angles are equal the sides are equal, therefore, the side c-d will equal the side d-e, so that the diameter at the top of the die will be:

$$4.310 + 6 = 10.310 \text{ inches.}$$

In milling machine operations we are frequently confronted with problems that might well be considered as coming under the head of taper work. Suppose we have a round piece of steel 1 inch in diameter to mill off so that the surface will have the form of an ellipse, the major axis of which will be 1¾ inches long, what will be the angle of inclination of the axis of the shaft?

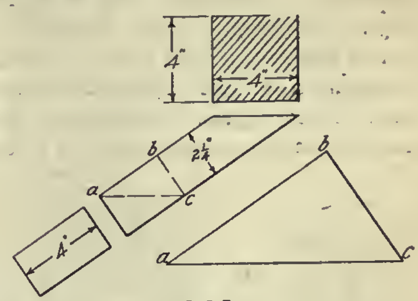


The angle required is that shown in the sketch and will equal (a) in the right triangle a, b, c. To find this angle use the "trig." formula:

$$\text{Sine} = \frac{\text{Side Opp.}}{\text{Hypot.}} = \frac{b-c}{a-c} = \frac{.5}{.875} = .57143$$

From a table of functions this value will correspond to an angle a shade over 33 degrees 50 minutes.

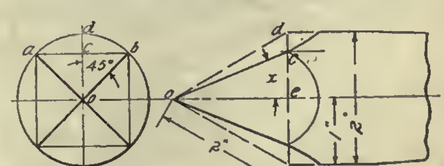
A bar of steel 2¼ x 4 is to be shaped or milled at one end so that the exposed portion will form a perfect square. It is desired to know the angle at which to set the bar so that a horizontal cross section will have the shape required. It is quite obvious, from the nature of the problem, that the narrow side will be parallel with the vertical plane. The solution is the same as that in the previous example and will be clear from the sketch below.



$$\text{Sine } a = \frac{2.25}{4} = .5625$$

and the angle corresponding equals 34 degrees 10 1-3 minutes.

In shops where heavy shafts have to be centred the square centre is a frequently-used tool. To have these made accurately it is often the practice to mill the cutting end to the desired shape, which, when finished, will have the corners uniformly inclined at an angle of 30 degrees with the axis of the centre. Below is show a sketch of a square centre in full lines, the dotted portion indicating the shape of the 60 degree turned centre.



X = 22° 12'

To find the angle of inclination it is necessary, first, to find the distance c, e. On the end view this is seen to be the length o, c, which may be found by solving the right triangle o, c, b. Knowing the length o, b (the radius of 1 inch) and the two acute angles to be equal, the length of one side may be found by extracting the square root of half the square root of o, b, or

$\sqrt{\frac{1}{2}\sqrt{0-\delta}} = \sqrt{\frac{1}{2} \text{ of } 1} = \sqrt{.5} = .7071$

```
  7          5000        7071
  7          49
 140         10000
   7          9849
 1407          15100
    7          14141
 14140           95900
     1
 14141
```

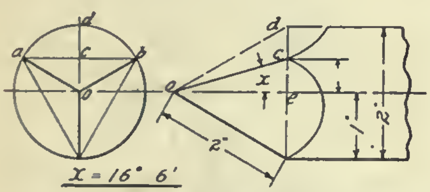
We now find the length o, e, which is done by the formula:

Side Adj. = Hypot. × cosine = 2 × .86603 = 1.73206

The desired angle o, in the right triangle c, o, e, is found by the formula:

$$\text{Tan.} = \frac{\text{Side Opp.}}{\text{Side Adj.}} = \frac{.707}{1.73206} = .40818$$

and the angle corresponding equals 22 degrees 12 minutes. Four sides milled at this angle will give a cutting angle of 60 degrees. In this instance the cutting angle can be measured with a centre gauge. Suppose, however, it was desired to secure the same result by using a triangular or three-sided centre; what would be the angle of inclination? As an aid to the solution the sketch is given.



As the angle a, o, c is equal to 60 degrees the length e, c may be found from the formula:

Side Adj. = Hyp. × cos. = 1 × .5 = .5 = ½ inch.

The length o, e is found by solving the right triangle o, e, d, and the formula used is:

Side Adj. = Hyp. × cos. = 2 × .866 = 1.732"

Then the angle c, o, e (angle of inclination) may be found from the formula:

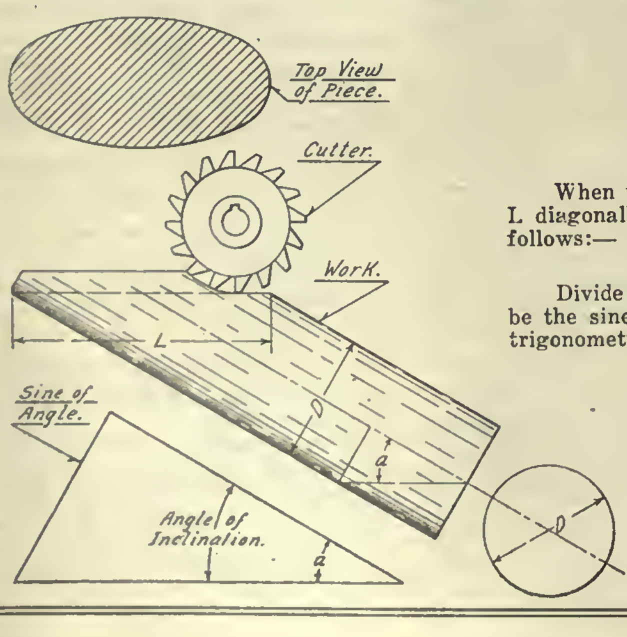
$$\text{Tangent} = \frac{\text{Side Opp.}}{\text{Side Adj.}} = \frac{.5}{1.732} = .28868$$

and the angle corresponding to this value is 16 degrees 6 minutes. This will be the angle at which to tilt the axis of the centre for milling the end and the indexing will be through an angle of 120 degrees.

A British firm has developed an apparatus for testing the physical qualities of steel after heat treatment by means of the magnetic method. The principle on which this instrument is based is that magnetic retentivity of a steel is a function of its hardness. The method of using this apparatus is as follows: First, a specimen (usually a turned piece 3 inches long by 1½ inches in diameter) is subjected to the heat treatment required to be investigated. It is then tested for magnetic hardness by being laid inside a standard magnetizing coil, and a direct current from the mains flashed on to the coil which magnetizes the steel to saturation. The specimen is then removed from the magnetizing coil and is placed in a small search coil, which is directly connected to a Grassot fluxometer, continues "Automotive Industries." The specimen is then sharply removed from the ballistic coil and a reading is obtained on the fluxmeter, which represents the hardness of the specimen. The scale of the fluxmeter is divided in terms of Maxwell-turns. With the search coil of correct design, the reading is also given in terms of C. G. S. units of coercive force, so that the results are in international accord.

Experience has shown that the practice of enclosing metal filament lamps of high candle-power in closed fittings is disadvantageous. According to the "Technical Review," a Swedish engineer, investigating the matter, has found that it is the rise in temperature which causes the rapid diminution in luminous intensity. He ran several incandescent lamps at temperatures of 200 deg. and 20 deg. C., while others cooled by a water circulation device were only at a temperature of 20 deg. or 3 deg. C. After some hours' running, in the case of the lamps at a temperature of 200 deg. C., the luminous intensity had dropped considerably, and they were unusable after forty hours' running, whereas with the lamps run at 20 deg. and 3 deg. C. the diminution of intensity was inappreciable after that period. This is apparently explained by the fact that at high temperature the glass of the bulb becomes porous and air enters the bulb, and it also explains why, where large numbers of lamps are arranged close together in advertisement signs, etc., they rapidly deteriorate.

Vancouver Harbor Board.—The Harbor Commissioners of Vancouver expect very shortly to complete the negotiations for the site at Burrard Inlet for the new harbor. The Great Northern property, which forms part of the proposed works, has been the stumbling block in the way of calling for tenders, but the owners of this property have decided on a price. This has been forwarded to the legal representative of the commissioners, Mr. McNeill, and the matter should soon be adjusted.



TAPER WORK
Milling Machine

When work has to be set at an angle to obtain a certain length L diagonally across a piece of stock, the angle A may be found as follows:—

Divide the diameter or width D by the length L. The result will be the sine of the angle (a), which may be found from a table of trigonometric functions.

Example:—A piece of 1½ inch round stock, is to be milled so that the diagonal section will have a length of 3 inches. What will be the angle of inclination?

.50000 Sine of angle (a)

This value, from a table of functions, will correspond to an angle of 30 degrees.

WHAT OUR READERS THINK AND DO

A SIMPLE JIG THAT WOULD NOT LEAD

By F. SCRIBER

Apparently a simple jig for drilling holes an inch apart in a staybolt tap is shown by Fig. 1, while the tap as drilled is illustrated by Fig. 2, where it will be noticed a series of holes are drilled in the shank so the bushing A may be advanced by even inches and clamped by the screw B at any desired position.

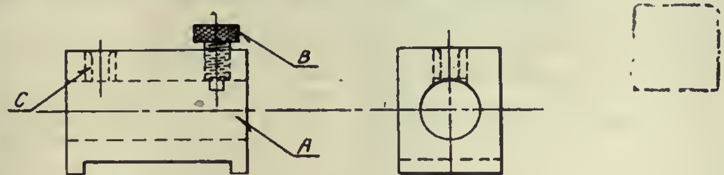


FIG. 1—THE JIG ITSELF.

The object of the jig Fig. 1 was, after correctly locating and drilling one hole, all others were drilled successively from this by setting the point of screw B into, first this hole and then progressively into each hole after it is drilled until all are machined by using the guide bushing C for piloting purposes.

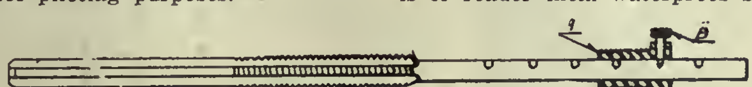


FIG. 2—THE METHOD EMPLOYED IN DRILLING THE TOP.

Ten holes were drilled in this manner and it was found almost impossible to have the last holes drilled in anything like the correct location, the last hole often being twenty-thousandths out owto the drill having a tendency to creep while cutting, usually in one direction and perhaps only .002 at each hole, which, multiplied by ten gives the great discrepancy noted.

Fig. 3 shows another instance where minor errors between shoulders on a shaft mount up to considerable in a long length with a number of shoulders, as an error of .005 between shoulders if always short will amount to .030 where six lengths are to be measured.

While mechanics familiar with accurate machining this class of work would not be apt to get fooled by this condition. The point to be observed in this connection is always work from one hole or the same shoulder or the same locating point if you would keep errors down to the minimum. This rule holds good on most all classes of work on both tool design and shop operations.

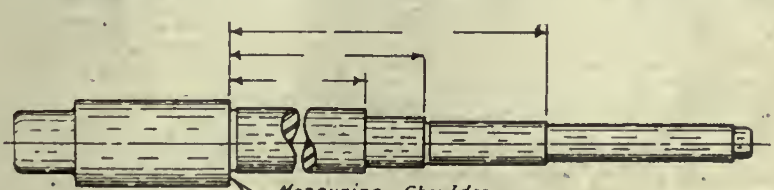


FIG. 3—ILLUSTRATING THE POSSIBILITY OF ERROR ON SHOULDER MEASUREMENTS.

WATERPROOFING BLUEPRINTS, DRAWINGS, ETC.

By F. A. McLEAN.

Architects, engineers, contractors, linemen, etc., are often compelled to refer to drawings, blueprints, etc., in all kinds of weather, with the result that before long the prints are in a very dilapidated condition.

A good way to overcome this trouble is to render them waterproof by saturating them with paraffine wax such as is used for sealing fruit jars, etc., and sold under the name of Parowax.

If the prints are placed directly into a pan filled with this molten wax, they will soak up too much of it and will always be more or less greasy to the touch. The most convenient way, therefore, is to soak a number of pieces of absorbent cotton cloth, about a foot or more square, in the wax. When these pieces of cloth are cool lay as many as are required (depending on the size of the blueprint) on a table or other smooth surface, place the print on top of these and then on top of the print lay more of the cloths until it is entirely covered. After this is done it is only necessary to run a hot iron over them for a few moments. The print will immediately absorb the paraffine until the surfaces become saturated. If the table on which the work is carried out has a highly-finished surface, a layer of wrapping paper should be placed between the cloths and the table. Should the domestic iron be used in the process it would be a good plan to interpose a piece of wrapping paper between the iron and the cloth, also as it may prevent a few hard words from friend wife.

CHART OF STRENGTH OF WOOD BEAMS

John S. Watts

THE accompanying chart gives the section modulii for rectangles up to 16 in. deep by 14 in. wide, and will prove useful for calculations on timber construction.

As it is frequently desirable to know what size of steel I-beams could be used as an alternative, the chart has been extended to show the sizes of I-beams having the same moment of resistance as any size of wood beam up to 16 in. by 14 in.

The stress is taken as 1,000 pounds per square inch for timber, which is safe for the commercial grades, and for the steel beams the stress is taken at 16,000 pounds per square inch.

Taking the stress at 1,000 pounds, the moment of resistance can be read directly off the chart by simply multiplying the section modulus by 1,000.

The moment of resistance for the wood beam as so found is, of course, also the moment of resistance for the steel beam on the same horizontal line.

It may be noted that, in every case up to the limit of the chart the wood beam will be cheaper, that is in first cost. Obviously, in permanent work there are many other considerations to be taken into account, but for comparison, taking steel at say 4 cents per pound, and timber at say $40 per thousand feet, board measure, we have as the cost of the steel beam per foot:

Weight for foot multiplied by 4 cents equals cost per foot in cents. And for the cost of the wood beam there will be in one lineal foot:

$$\frac{\text{area of the beam}}{12} = \text{feet board measure.}$$

Therefore the cost per foot will be

$$\frac{\text{area of the beam}}{12} \times 4 \text{ cents.}$$

The area of the wood beam therefore requires to be twelve times the weight of the steel beam per foot to equal it in cost, which a trial will show the wood beams do not nearly approach.

To use the chart to find the size of beam required for a given moment of resistance, follow along the horizontal line for this moment and read off the sizes at the intersection of each diagonal and vertical line on this horizontal line.

Also at the right, on this same horizontal line, we find the size of the steel I-beam required to give the same moment of resistance.

For example, if we required a beam to have a moment of resistance of 250,000 pounds, following along the 250 line, we get the choice of the following sizes of wood beams: 10½ in. x 14 in.; 11 in. x 13 in.; 12 in. x 11 in.; 13 in. x 9 in.; 14 in. x 8 in.; 15 in. x 7 in., or 16 in. x 6 in., the first dimension being the height of the beam in each case. Continuing along to the vertical line at the right, we find that an 8 in. x 23 in. I-beam is the equivalent in strength to the aforesaid wood beams.

In the matter of cost, as pointed out above, the wood beams would require to have an area of 23 x 12 = 276 square inches to equal the cost of the steel beam, whereas the largest, i.e., the 10½ in. x 14 in., has only 147 square inches, therefore the cost would be only a little over half of that of the I-beam.

In a paper on "The Policy of the Air Board of Canada," read at one of the business sessions of the Engineering Institute convention by Lt.-Col. O. M. Biggar, vice-chairman of the Canadian Air Board, the speaker outlines the dedevelopment of transportation from the time of the foot runner up to the present time. In speaking of the future possibilities of commercial air service, he touched on the remarkable progress that hade been made during the period of the war, but as this achievement had been made regardless of all costs it would be the duty of the engineers of the country to take hold of this problem and solve it so that the airship could take its proper place in the competitive commercial transportation of the future. The tremendous rate of depreciation on flying machines at present (about $25 per hour on a $10,000 machine) was a factor that minimized their value as a commercial enterprise. Lt.-Col. Biggar predicts a pleasing future for the air service. "There has been such progress in aviation," he said, "that I have no doubt that well within ten years in Canada people will be regularly, but expensively, travelling by air routes, with carriage of certain mails in the same way. With ordinary Government encouragement there is certain to be a tremendous change in our methods of communication as a result of the development of the use of the air. It will not be a cheap method, but it is for the engineers to devise means to make it cheaper, and the future years will see its use to a continually increasing extent, both for civil, mail and military purposes."

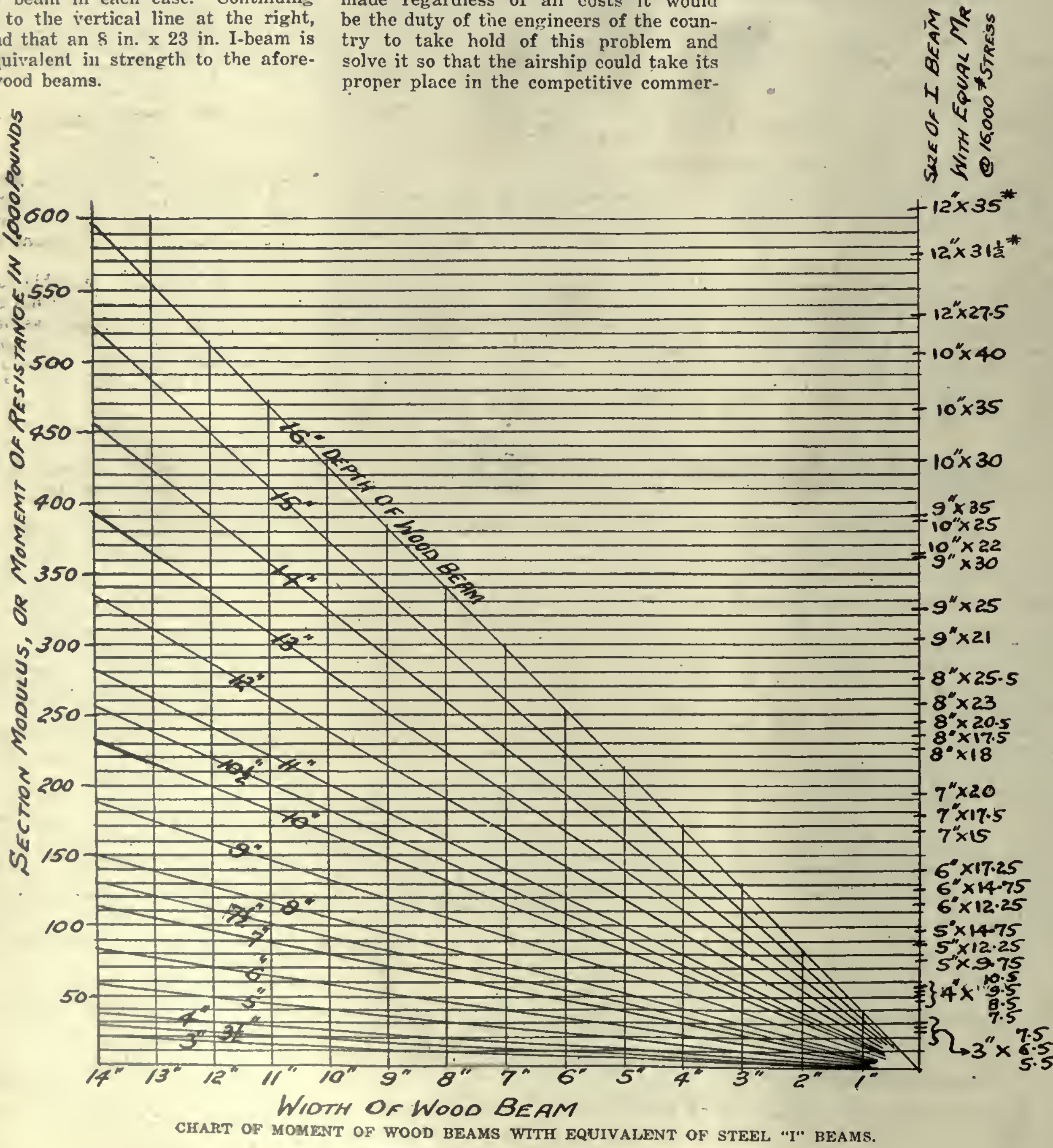


CHART OF MOMENT OF WOOD BEAMS WITH EQUIVALENT OF STEEL "I" BEAMS.

The Ludlum Type of Electric Furnace

An Electric Furnace Distinguished by the Ellipsoidal Shape of the Hearth and by the Arrangement of the Three-Phase Electrodes in Line Which Ensures Proper Heat Distribution

By W. F. SUTHERLAND

IN the manufacture of tool and alloy steels, where refinement is the first consideration, the electric furnace has proven itself superior to the crucible, not only in turning out a more consistently uniform steel of any given analysis, but likewise accomplishing this at less cost than by the older method.

The reason for this is plain in the first place, when it is considered that the electric tool steel manufacturer does not have to purchase selected grades of raw material, but can refine the mix in his furnace.

So, too, in the foundry, the electric furnace is the modern method of melting. The demand is for superior castings. Consequently, the refinement of the metal must be almost as accurate as in the manufacture of tool steel. The rare alloys are frequently added in the process. The percentage of sound and serviceable castings is here the first consideration.

The electric furnace has yet another use in the metallurgy of iron and steel and for the production of pig iron from scrap it has found considerable use, particularly during the war. The Ludlum electric furnace described in this article is being successfully used at the present for the commercial production of the finest quality of cast steel, cast iron, low phosphorous pig iron and washed metal.

Low phosphorus, low sulphur pig iron has been made successfully, both in the plant of the Metal Alloys, Inc., at Watervliet, N.Y., and at the plant of the Omaha Structural Steel Works at Omaha, Nebraska. The operations at Watervliet were more or less in the nature of a war expedient and were abandoned after the armistice on account of the facilities being required for more remunerative work. At the plant of the Omaha Structural Steel Works, where the furnace was put in operation about August 1, they have been making high silicon, low phosphorous, low sulphur pig iron, using a charge consisting of 1,500 lbs. of cast iron borings and 500 lbs. of stove plate, or steel shoveling scrap in a one-ton Ludlum furnace.

Over 200 tons of cast metal have been made by this firm with an electrode consumption of as low as six lbs. per ton and with an average power consumption per ton of less than 600 kw.

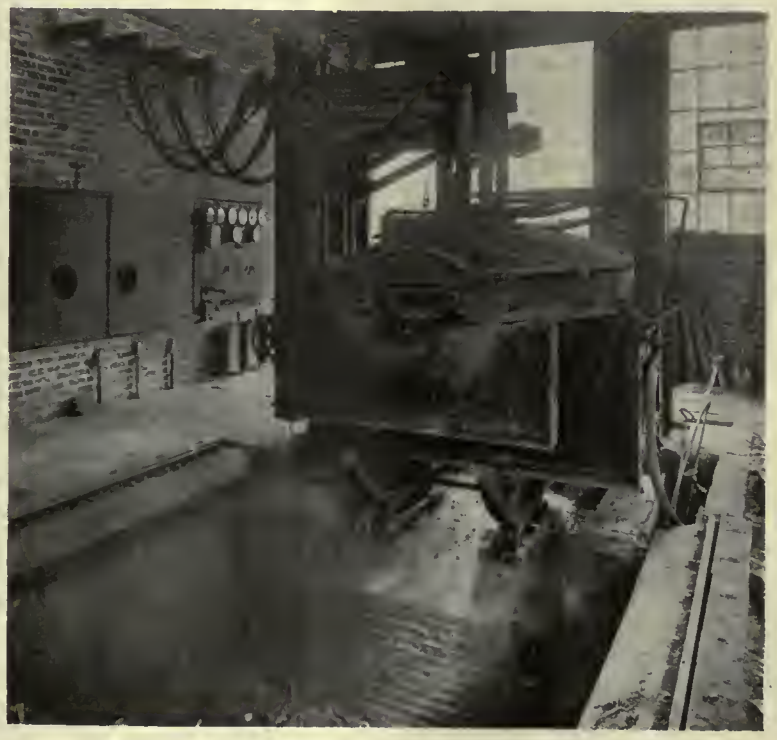
The electrodes are 4 in. graphite, the transformer operating the furnace is a 400 kv-a., Pittsburgh, 3 phase, self cooled, and stepping down the high tension voltage from 13,200 to 110.

This particular furnace is basic lined and no replacements have as yet taken place, the only expense being a small amount of syndolag for patching the bottom, which consists of sintered magnesite on a base of magnesite bricks. It may be mentioned in passing that furnaces of this type operating under much more difficult conditions have been run for more than 2,000 heats with the bottom still in excellent condition.

The pig is run in a sand bed and is afterwards charged in a grey iron foundry in the ordinary way. Castings made from this metal carry a scrap burden equal to, if not greater, than ordinary pig and at the same time the castings made from it have grain about twice as close as the standard pig, are free from inclusions and have a tensile strength of about 3,800 lbs., as against 1,800 for grey iron. This same furnace at Omaha is used during the day shift for steel casting.

The Ludlum electric furnace is an ellipsoidal crucible, consisting of a steel shell, lined preferably with magnesite brick, and covered by a low arched roof of firebrick. Three electrodes are used and these pierce the roof along the centre line, and are held in position by bronze arms projecting from upright beams attached to the furnace structure. These arms can be raised and lowered either by hand wheels or automatic control. There are no bottom connections, nor water-cooled parts below the bath.

There are only two doors, one at either end of the furnace, and no spout. Through these doors every part of the interior is easily accessible from a variety of angles. The furnace can be charged from both ends at once.



GENERAL ARRANGEMENT LUDLUM ELECTRIC FURNACE.

The furnace structure is supported on two sets of rollers, and is tilted by an electric motor to pour through one of the doors. The latest model is built to pour at only one end, and is back heavy as a measure of safety.

The furnace is as small for its capacity as it can be made. This means a very high efficiency due to a minimum: First, of exterior radiating surface; second, of space in the furnace unoccupied by the charge third, of refractory lining required fourth, of electrodes exposed.

To anyone familiar with drawing and setting the slag in electric furnace operation, and patching the lining at the end of a heat the advantages of the design here described should be apparent. Every part of the slag and every part of the lining after the metal is poured is directly accessible through one or other of the two openings.

For basic operation the hearth is lined with magnesite to a thickness of 9 inches or more. A lining will last for several months of continuous operation; and with careful and proper patching its life should be extended many times that long. The shape of the furnace itself is conducive to long life since none of the walls overhang the bath, even when the furnace is tilted. Straight lines are eliminated and the lining is thus stronger through the keying action of the bricks themselves. When the Ludlum furnace requires relining, the whole job can be done from the moment the last heat is poured till the moment when fully lined and thoroughly dried, it is ready to be charged again, in twenty-four hours.

The roof of this type of furnace is a low arch built of fireclay brick.

The flat arch construction reduces the compression in the brick to one plane, instead of a number of planes as in the dome type. It has been found that it will last for several weeks of continuous operation.

In practice, an extra roof is built on a separate roof frame, and is ready to replace the old one at any time. This is most conveniently done when a new charge of scrap is loaded into the furnace, thus losing a minimum of heat in the operation. The charge hardly delays for a moment the ordinary routine.

Operation

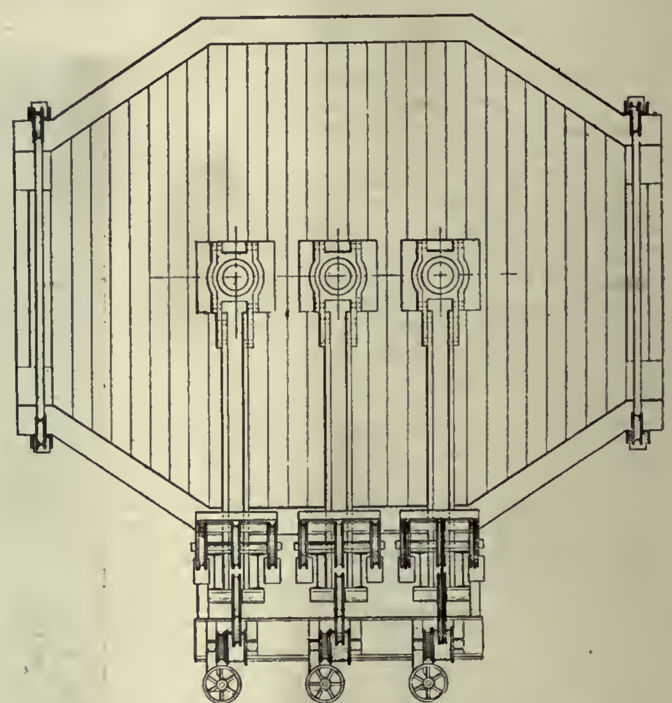
When a charge of scrap is to be melted down, the furnace is filled with the charge. There is no waste space to be heated and a minimum exposure of the electrodes within the furnace. The Ludlum is as small for its capacity as it can posibly be made and therefore as economical.

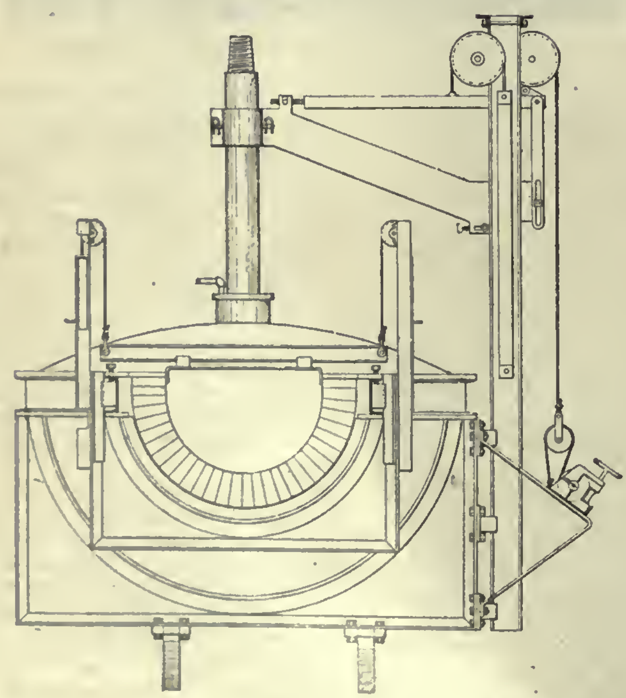
The electrodes at first rest on the charge and as soon as the current is turned on, eat their way through nearly to the bottom. By the time they have melted their way through there is a pool of molten metal beneath them, for there is no deeper part of the Ludlum hearth than that directly beneath the electrodes. The charge is melted from the bottom up, the arcs remaining smothered in the scrap until it is completely melted down. Practically no heat is lost in the operation and the roof is not exposed to the high temperature radiating from an open arc.

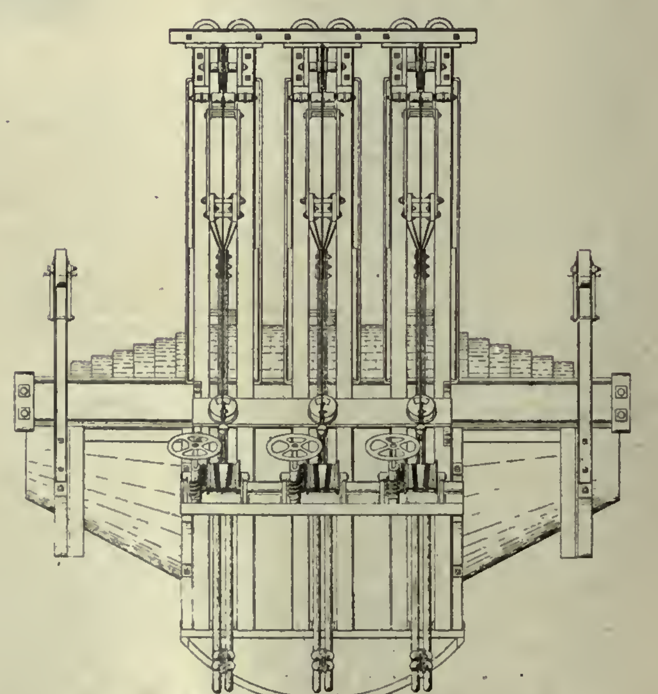
In refining alloy tool steel, with the use of two slags, the makers state that the current consumed is very small, about 500 kilowatt hours per ton. The power factor is about 90 per cent.

The use of the electric furnace for the production of high grade steels of all analyses for a period of years has convinced the Ludlum Steel Company of its superiority. This superiority results from the ability to use cheap raw material, even turnings, by reason of the refining ability of the basic hearth; low melting loss, even with small size scrap and an atmosphere which can be controlled to a nicety. This latter feature makes thorough dephosphorizing and desulphurizing, while it also prevents loss of alloys present or added to the steel by reason of the reducing atmosphere obtainable.

The electric arc permits the attain-







PLAN, END AND SIDE ELEVATIONS OF LUDLUM FURNACE.

ing of temperatures above those attainable by any other heating medium, while it gives a clean heat and introduces no contamination or chemical change per se in the charge. Thermal conditions can be accurately reproduced and maintained as desired.

Crucible quality steel of uniform analysis can be produced in large charges from cheap raw material because of the

(a) Refining ability.

(b) Control of temperature possible.

(c) Cleanliness of heating medium and ability to have heating uniform in all parts of the bath.

The electric furnace produces better ingots as flexible temperature control reduces piping and segregation by permitting pouring at the most advantageous temperature for the size of the ingot and the analysis produced by other methods, because of the absence of included slag, non-ferrous segregation and gases.

Specific Claims

The makers of the Ludlum furnace state that it operates smoothly, with small surges, which are prevented from reaching the power company's lines by the use of suitably designed static transformer equipment and automatic electrode regulation.

Due to the correct design of low tension conductors and other equipment, the average operating power factor is at least 90 per cent.

The Ludlum furnace may be provided with either an acid or basic lining, as desired, but lends itself most efficiently to basic operation, because of its maximum of refining ability. For this reason, except for a few special purposes, the makers advocate and furnish a basic-lined furnace, believing that the more expensive basic lining is more than compensated for by the lower cost of raw material used and the higher grade of the output obtained.

The design of the shape of the Ludlum furnace:—

(a) Permits supplying energy to the furnace at a high rate, within the critical limits of the refractories, resulting in quick heats which assist in attaining as low power consumption per ton of metal as is possible for producing a given desired temperature of the bath.

(b) Permits thorough refining by reason of the large area of contact between the slag and steel attained with a shallow bath of large superficial area.

(c) Permits the proper circulation of the entire bath for mixing the charge, which is brought about by the arrangement of the three electrodes in one plane coincident with the major axis of the elliptical hearth, whereby the reaction of the currents between the electrodes provide circulation by electro-dynamic means as well as convection currents.

(d) This electrode arrangement, operating on three-phase energy, results in the production of an equal amount of heat at each electrode. The greater amount of heat in proportion to the mass of the bath at the ends cares for the greater radiation at the doors and results in an even temperature, gradient throughout the bath, which favors long refractory life.

(e) Makes sintering in lining easy, as but one piece of scrap electrode is required to reach all three arcs.

(f) Reduces danger of breakage of electrodes as the maximum of space for operating rabbles, test spoons, etc., is available without coming in contact with electrodes.

(g) The use of graphite electrodes reduces the weight of electrodes handled and storage space required; facilitates making of joints having the best electrical and mechanical properties and reduces the freight and handling charges for electrode material per ton of steel.

(h) Requires but two doors, one at each end of the major axis. These doors serve as charging doors and pouring spout and from them every part of the bath is accessible and the lining can be inspected and repaired with a minimum of effort. This makes the care of the bottom simple and results in long refractory life.

(i) The hearth meets the roof without any intervening vertical side walls so that no space is wasted. The contour of furnace interior approximates the natural contour of a pile of cold charge. The cubic contents of a Ludlum furnace is but ½ to 1-3 that of round or square shell types of the same capacity. This, and the small exterior surface exposed, results in high thermal efficiency and favorable power consumption.

(j) The comparatively low roof results in the reduction of electrode consumption as a minimum length of electrode is exposed to oxidation when dephosphorizing and when charging.

(k) This shape of hearth, tilted in a plane, parallel to the major axis of the furnace, permits thorough clearing of the metal with a motion of only 30° from the horizontal and no refractories overhang the bath at any position of tilting.

(l) No special shapes of brick or exceptionally skilled masons are required to line the hearth or roof and the expansion of the refractories, which takes place when the furnace is heated, is adequately cared for by its shape. The design of the roof arch is simple and provides a very uniform distribution of reflected heat. Favorable thermal conditions permit the use of firebrick roof, which somewhat reduces refractory costs as with proper care the basic sintered lining has an extremely long life.

(m) The arrangement of electrodes and the shape of the bottom results in the formation of a metal pool, which extends under all three electrodes by the time they have cut through the charge. This metal protects the bottom refractories from the arcs and allows melting from the bottom up without injuring the lining. The charge acts as a blanket, which absorbs the excess heat, increases the speed of melting, by being preheated therefrom and protects the roof from the heat until the entire charge is molten, when the covering slag tends to perform the same function.

If, in a photographic dark-room illuminated by red light, the face of a watch with a so-called "luminous" dial be observed, a curious effect is noticed. When the watch is moved to and fro, in the plane of the dial, the green luminous figures appear dissociated from the red illuminated dial and apparently are displaced and lag behind its movement. The illumination by the red light requires adjustment so as to be suitably related to the brightness of the luminous figures and the eye should remain in darkness for 15 to 20 minutes in order to get the best effect.

SHOWING DETAILS OF ROOF STRUCTURE.

"Be Able to Do It Yourself" is the Text Here

Grant Hall, Vice-President of the C.P.R., Has Come Up Through the School of Practical Railway Shop Work—Understands the Problems the Men Have to Deal With Every Day

By Joseph Lister, in *MacLean's Magazine*

"BE able to do it yourself."

Probably the whole law and the gospels of Grant Hall, the new vice-president of the Canadian Pacific Railway, are summed up in these simple words. He has made a fetish of not only getting the thing done, but being able to do it himself, and therefore it is that he has climbed steadily from an apprentice machinist in the Point St. Charles yards of the Grand Trunk Railway to the second highest office in the gift of the Canadian Pacific Railway.

This isn't the story of the rise of a horny-handed son of toil. If Grant Hall's hands were horny, it was not because they were born that way, but because his particular ambition was to be able to do what he set his hands to do with efficiency, and he believed the way to do it was to know all about how it was done.

When he left Bishop's College, Lennoxville, Que., a school of some social standing, it was not to seek a profession but to find a job that would make him capable of handling the profession when it came. So it was that he laid aside the college cap with its nicely worked crest on the front, and donned his suit of blue overalls, and started in to learn railroading by way of the underside of the engine—the engine as it looks from the repair pits.

Soft hands soon grew calloused and grimy as to fingernails, and the natty blue overalls were streaked with grease; but Grant Hall knew something about a locomotive from about any angle you might want to view it. Inside or out, it was all the same to him. Three years later he joined the Canadian Pacific Railway, where he learned about all there was to know of the drudgery work of a railroad. But he stuck it, till he got an offer from the Intercolonial Railway to become their general locomotive foreman, with headquarters at Moncton, N.B. Locomotives were dear to the heart of Grant Hall, and the thought of having complete charge of these black beauties, of having the opportunity to learn more of them, to know what they could and could not do, and how they might be cared for to get the maximum result, drew him irresistibly, and he went.

Back Again to the C. P. R.

Five years later he was once again back with the C.P.R. Was locomotive foreman of the Windsor Depot, Montreal; and general foreman at McAdam Junction, Que., a year later. Up to that time he had been an Eastern man, knowing the Eastern end of the system. A change came quickly.. He was made general foreman at Winnipeg, and only a brief time later he was appointed master mechanic at Revelstoke, B.C. In 1902 he was back East again as assistant superintendent of rolling stock, to move West again in two years' time as assistant superintendent of motive power for the Western lines.

Fifteen years out of a nice finishing school, and he still knew more about the underside of an engine than about mahogany desks. But the mahogany desk time was coming, coming because the man who was to sit behind it did know about engines, about road conditions, and most of all about the men who drove these engines and maintained these road conditions. In 1908 he was made superintendent of motive power for the Western Division. Three years later he was assistant general manager of Western lines, then general manager of Western lines, and now vice-president of the company, in charge of the Western Division.

GRANT HALL
Vice-President C.P.R.

The Mahogany Desk at Last

There you have the mahogany desk, and behind it a man who has done about everything there is to do in the business of railroading with his own hands. When Grant Hall sets out to get the thing done now, he is not hampered, as so many executives are, by the smiling superiority of the man who knows the actual conditions, for he knows them himself. He has had his own fingers nipped throwing switches in a crowded freight yard in mid-winter, and he knows that it can be done. He knows, too, that throwing switches is hard to do, and these two facts are facts that stand out strongly in his viewpoint on the thing. It is going to be done, and the men who do it are going to get due credit.

While Mr. Hall was in charge at Revelstoke, some dozen or more years ago, there occurred one of the worst snow blockades in the Rockies in the history of the railway. Trains were tied up everywhere, and communication with the Pacific coast was cut off. It was a matter of digging a roadway through, an

almost herculean task. Grant Hall did not send men out to do it. He took them with him, and he stayed on the job every minute of the time. He is a driver; but he has his own method of driving. Probably the men who went out to dig that pathway for a transcontinental railway through the drifts had never worked as hard in their lives before, but there wasn't one of them who wouldn't have admitted that they had nothing on Hall in that regard. When the first gang went off duty, stiff and weary from the back-splitting work, Grant Hall stayed.

"I'll get the relief started," he declared.

He not only got the relief started, but he stayed with them to the end of the turn, wielding a shovel as zealously as ever. And he saw the first crowd back on the job as well.

He was there every hour of the twenty-four for a whole week. He stuck right with it. He called the men Jim and Bill and Pat; and Jim and Bill and Pat were their names. And there were times when the men forgot formalities, and hailed him down the line as "Grant."

They cut that road through, cut it through in a week, when everyone was pretty well ready to admit that the thing couldn't be done till Nature came along with a thaw.

It is that sort of thing that has made Grant Hall a favorite with the railwaymen. He not only works them, but works with them. Moreover, for all that he is placed in authority, he hasn't let that authority turn his head, and is as ready to accept advice as he was back in the old C.P.R. yards at Hochelaga, when he was busily engaged in learning his way about a locomotive.

Rewarding One Kind of Disobedience

There is one interesting story that they tell of him in this regard. Some time ago, some yardmen in a Western yard had been discharged for breaches of the company's rules. The yardmaster, feeling that they were good men, asked that they be reinstated in the company's service. He got a very definite statement from Mr. Hall, who was then general manager, that such a thing could not be done. Some time later, an assistant yardmaster was dismissed for drunkenness, and the switchman went on strike in an effort to force his reinstatement. The yardmaster was in a quandary. The wheat rush was on, and his yards were crowding up. Given a few more hours of inactivity they would be in a hopeless tangle that would take days to unravel. Then he remembered the men who had been discharged some time before and whom the general manager had refused to reinstate. They were all experienced men, the sort he needed badly. He called them together.

"Get on the job," he said, "and get those cars moving. I'm putting you on against orders, but I need you and I think you can do the trick. I'm going to take the chance of making the G. M. see it my way."

They went to work and untangled that yard in a way that was a delight to watch. Then, the yard cleared, the yardmaster reported to the trainmaster, and the trainmaster to the superintendent, and finally the voluminous report reached Mr. Hall. Under it the superintendent had written:

"What shall I do with a man who disobeys orders to the extent of putting men to work when the General Manager has refused to do so?" Without a moment's hesitation, the General Manager wrote after the query the laconic reply:

"Promote him the first chance you get."

That is Grant Hall. It didn't hurt his vanity that the man had disobeyed his orders. The yardmaster had been deputed to attend to certain duties. He had used his own judgment in carrying them out, and he had kept the yard clear. That was the main point, and the answer was: "Promote him the first chance you get."

Something About the Man

Grant Hall, for all that he was born in the East and got his early training there, has all the marks of a Westerner. A big man, upwards of six feet in height and tipping the scale at something a trifle over 200 pounds, with big hands and a square-set jaw, and a big voice that comes from the depths of his chest, he is the sort of man that is supposed to thrive better in the West than elsewhere. Anyway, he has been long enough in the West to learn its free and open-handed ways. Probably there is no man on the whole system who knows more men personally, or can call more by their first names than Grant Hall. That is no mean gift in itself. Call a man by his first name without patronage or boasting, and you have gone a long way toward reaching his heart. Mr. Hall does it because he likes men, and likes to know them and the men know it, and that is the reason he is pretty generally known as "Grant" from one end of the system to the other.

He is a big-hearted, kindly man of the most approachable kind, with a stability of brain and muscle that is suggested by his size. He is a man of swift judgments and as swift action. Petty difficulties don't embarrass him to any extent, because he pays them only a very passing attention. He has something to do, and he is at it all his waking hours. While in Winnipeg, he walked every morning from his home to his office, in order to keep himself in trim. It was quite a little step, about three miles; but every mornng he was at his desk well before nine o'clock, having stepped that three miles in well under an hour.

His appointment as vice-president pleased pretty well everyone on the road, for he is about as generally liked as anyone could be, and it was a most satisfactory appointment, as far as the business and agricultural interests were concerned, for they believe in his sincere desire to serve not only the interests of the railroad but of the people as well. It is claimed for him also, that when you get down to brass tacks, there isn't a man in Canada who can equal his positively uncanny knowledge of the motive power of a railroad, or has a wider knowledge of the mechanical features of the operation of a great transcontinental line.

It is this actual understanding of the details of the thing to be done, combined with his approachableness, that has made him such a favorite with the men of the railway. They are ready to grant his superior wisdom and vision; he not only knows his own work, which is beyond their horizon, but he knows their work as well. For that they are ready to yield him an unstinted respect. They know he is not going to ask of them more than a man can expect of a good worker, for he knows what the limits are. He is not going to ask less, because he measures men by the same standards he has set for himself.

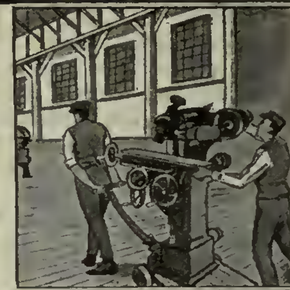
THE INDUSTRIAL SUPERMAN

At a recent meeting of the Montreal Young Men's Canadian Club, Dr. H. A. Garfield, formerly United States Fuel Controller, spoke on a subject that is having a vital bearing on the stability of modern commercial evolution. The title of the address was: "The Industrial Superman," and the substance was based on the pitfalls of prosperity with which we are surrounded at the present time in the shape of exaggerated labor demands, particularly where such is accompanied by cessation of work that reduces the production of the necessities of life. This present form of industrial tyranny, the speaker said, is taking the place of that which was so pronounced a short generation ago, when the large trusts and corporations threatened to disrupt the peace of America. After dwelling on the serious effects of present day tyranny, the speaker said that the need of the hour was not a method of settling industrial disputes but rather a permanent means of prevention. The machinery to effect this should, in his opinion, be a consultative or advisory body composed of equal representation of capital and labor engaged in the industry, together with public representatives appointed by the Government. Mr. Garfield thought that a distinction should be made between the finding of the facts and administration policies, and that each of these duties should be handled by separate agencies.

"I'm going to the ball game this afternoon. I'm anxious to see our new ball player."

"My dear, it won't do you a bit of good to go. I saw by the paper that he died trying to steal third."

DEVELOPMENTS IN SHOP EQUIPMENT



INSTANTANEOUS WATER HEATER

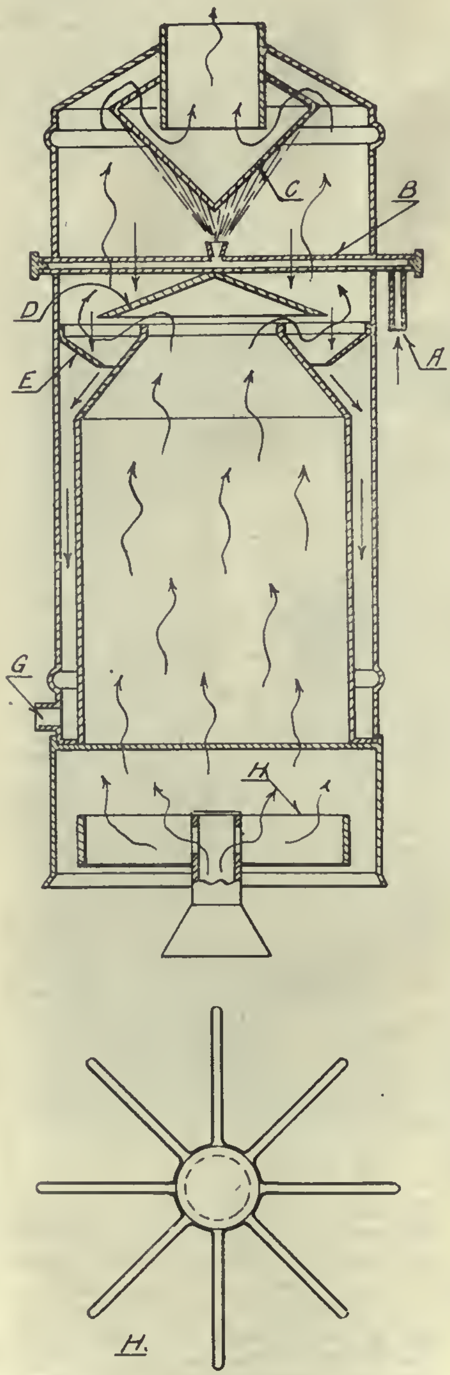
THE accompanying cuts illustrate a new type of water heater that is being made for the trade by the Dominion Welding Mfg. Co. of Montreal. The principle used in heating the water is that of bringing the heat from the burning fuel into direct contact with the water in its passage from the inlet to the outlet of the container. This method provides for the utilization of every heat unit produced by the gas, and when properly regulated there is absolutely no loss of heat. The flow of the water and the consumption of gas can be easily regulated and the control of both is obtained by the single lever shown directly in front and a little below the container.

This water heater requires no cumbersome tank, and can be supported by the fittings that are used to secure it in position on the wall or any other convenient location. The water does not lie stagnant while not in use, as there is practically no water in the tank at any time, the outlet being at the lowest portion of the water chamber. Even when in use the water passing through is virtually in suspension, weight is ever placed on the appliance. This permits the container to be made of light sheet steel that permits of instantaneous heating of the water when heater is operating.

The construction of the heater is shown in the line sketch. The cold water enters at A and passes into the cross pipe B and out at the opening in the middle where it is sprayed against the inverted cone C, thence dropping in succession to the baffle plates D and E and on to the inclined roof F of the inner portion, from where it flows down the side to lower level to the outlet G. It will be seen that the heat—shown by the staggered arrows — must pass directly through the sheet of water as it drops from one baffle to another, thus absorbing all the heat of cumbustion.

The burner is of special type, being made of strip steel, bent to the shape shown at H and welded along the bottom edge and to the central pipe connection, which has small openings leading into each radial section. The thin edges of the sheet steel burner permits of free mixture of the air and gas, resulting in good combustion. These heaters are being made for the trade both in domestic and factory use and are being distributed through the Welding and Supplies Co. of Montreal.

GENERAL VIEW OF THE HEATER.



SKETCH SHOWING CONSTRUCTION OF HEATER.

NAMCO BAR POINTING MACHINE

The National Acme Co., Cleveland, O., have placed on the market their Namco bar pointing machine to meet the requirements of manufacturers in general.

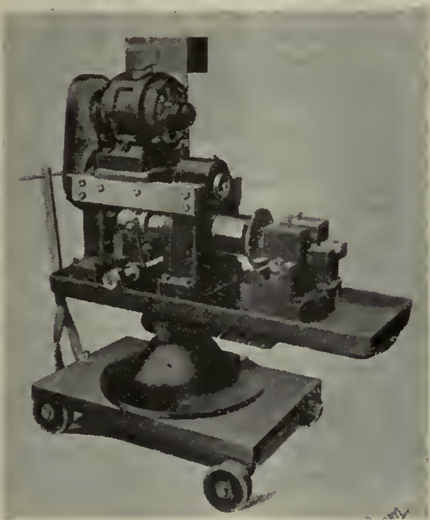
This machine was first built to meet the requirements of their own screw machine business which comprehends the cutting from the bar hundreds of millions of pieces yearly, and is therefore the logical result of their experience in a constant endeavor to discover faster methods where quantity production is sought.

The operating mechanism is very simple—consisting mainly of a gear-driven spindle carrying a plain turning tool in a revolving cutter head, a chuck and a hand lever. The chuck is provided with jaws which are quickly adjustable to accommodate practically all diameters and shapes of bars.

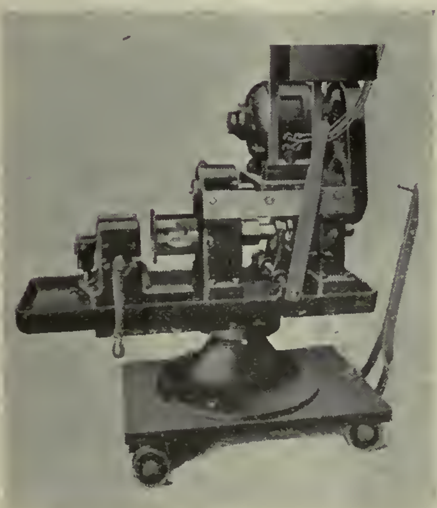
Round bars are pushed into the chuck,

gripped and the tool fed to the bar by the hand lever.

Hexagon and square stock are even



REAR VIEW OF THE MACHINE.



FRONT VIEW OF THE MACHINE.

easier to handle as no gripping is required. They are simply pushed against the tool which revolves in one position and withdrawn, requiring only one movement of operator.

Where quanties of stock are handled, two machines, operating end to end, as shown, are used to advantage. Two laborers, each holding the bar near the ends, lift it to one machine and then to the other, and in two movements point both ends. On heavy work, two men on two machines, point nearly twice the number of bars that could be done on one machine.

Aside from the saving of time, several advantages of machine pointing over wheel grinding are important. The ends of the bars are evenly pointed—no high spots. Bars with particles of emery ground into the ends are damaging to machines, tools and bearings—eliminated entirely. Reduced grinding wheel expense, and no dust for operators.

The machine is mounted on a truck for convenient hauling from one stock bin to another, and is frequently used as the stock is taken from the freight cars, thus saving much of the expense of second handling.

It is driven by one horsepower motor which may be connected up to any convenient electrical circuit.

Dimensions of the machine are: Four feet long; four feet high, with motor, two feet wide.

USING MAGNETS IN CONJUNCTION WITH ELECTRIC CRANES.

TWO MACHINES OPERATING END TO END. THIS ARRANGEMENT WORKS VERY ADVANTAGEOUSLY.

The MacLean Publishing Company

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PRINCIPAL CONTENTS

We Might Grow Hungry

IN the Western States a certain section of farmers got together and threatened the people in the city that they would grow just enough for their own use, and no more.

The beauty about those threats is that we don't believe them.

At the same time, they give one something to think about.

The farmers claimed that they were working from 12 to 16 hours a day, while the people in the city were working about half that time. They claimed that the short hours people worked in cities shoved up prices of everything they had to buy.

Let it go at that. It serves no good purpose here to argue that the farmer is dipping into the high prices the same as the rest of the profiteers. The point is this—we lose sight too readily of the fact that there's a great group of us camping on the trail of the man who grows things to eat.

We like to sit back and talk, and figure out why people are leaving the farm and going to the cities and towns. We can figure it all out that the thing is wrong. It's as easy as mud for us to show why the other fellow should stay on the farm, or why the other fellow should leave the city and go back to the farm.

But with all this argument—and against all this very good reasoning—we fail to see any excursion parties leaving the cities or the towns and heading for the farms.

And so it is that we still have in increasing volume the spectacle of a lot of people standing around waiting for some other chap to gouge a hole in the ground and plant seeds or roots, and finally bring forth something for the mob to eat.

No Other Obligation?

THE Supreme Court in Montreal has handed out a decision that is interesting. Olivier Decarie was sued for $432. He bought a car of tomatoes, part of which he claimed were bad. He deducted $432 for the ones he claimed were bad and paid $600 for the balance. Suit followed and defendant was ordered to pay the remaining $432, the judge holding that the goods were open to inspection, and the purchaser could have found the condition of the goods before accepting them.

Chances are that the decision is right enough, as far as the interpretation of the law goes, but is there no moral obligation in connection with such a matter? Is there any good reason why a dealer should seek pay for tomatoes, or anything else, which were not good, and the handling of which meant a loss to his customer?

Years of Service

THIS is an age when people are supposed to remain in the employ of one firm only a short time. Wanderlust has become quite an industrial disease. Good times and lots of work may help this along.

In a recent issue of the "North-Eastern Railway Magazine" there is a list of pensioners' deaths. Here are some of them showing the length of service:—

J. Sanderson, 46 years' service; S. Burniston, 43; C. Orman, 32; T. H. Birch, 29; J. Mitchison, 27; R. Hutchinson, 38; Hy. Ashford, 30; Wm. Preston, 46; J. Catchpole, 45; E. V. Lambert, 46.

The average length of service of these 12 pensioners was a little over 38 years, certainly a rarity in these days when employees have the hop, step and jump notion of employment so thoroughly developed.

The Good Old Styles

THERE'S not much end to ways and styles that folks is usin' now, and some is awful common like and lowly in the brow. While others aim at higher planes, a most delightful thing, and of them now let's string our lyre and raise a voice and sing.

There's lots of folks wear dinky hats what squat upon their head, in temperatures that make the snout turn most alarmin' red—they walk along the streets they do, in manner quiet and smug, a hangin' to their nose a spell and wackin' at their lug.

And on their hands they wear, they do, gloves of some dainty hue, what let their fists become at onct both numb and freezin' blue.

Upon their feet they grow silk socks, yes pleasant things in June, but ugly things, my lad, by heck, when frost hangs on the moon.

And there they strut both to and fro, rigged out in truck like that, silk socks, and gloves to torture them, likewise a cardboard hat.

Bring back, my son, the armament, we wore in days of yore, them days what's fled and gone, my boy, yes gone to come no more. 'Twas then we had the woollen mitts, the fuzzy knitted kind, the old wool scarf around the neck that hatched fine peace of mind.

And on our head there rested sweet a cap both deep and wide, with fur and wool entwined, by gum, and restin' side by side. And ear-tabs, too, was sprouted there, the things was built to last, and save my brains from being exposed to every wintry blast.

Ah, yes, bring back them things once more, that I may walk about, without a frozen set of feet, without a chilly snout. Yes, let me put those wool socks on, wool mitts upon my paws, a scarf about my chilly neck in either frosts or thaws, and on my dome then place that cap, so I'll raise up my song unto the comforts of the lid what has the ear-flaps on.—ARK.

HARD FOR U.S. FIRMS TO ABSORB EXCHANGE

Coal Co. Had Been Facing a Peculiar Situation—What it Would Mean to Take Up the Exchange

IT IS interesting to know how certain American lines view the exchange situation. CANADIAN MACHINERY had an interesting interview with the Ohio and Michigan Coal Co., Detroit, in which they went into some detailed figures to show the problems they were facing at the present moment, and the difficulties they had in making collections. Their view, in part, amounts to this:—

"We value highly our Canadian trade, but must say a word in defense of the coal industry insisting upon collecting the exchange rate in full, and we wish you would give the reasons for this, from the standpoint of our industry, as much prominence and publicity as you can so that Canadian coal consumers, now unfortunately penalized by this outrageous exchange rate, may understand why we cannot absorb the exchange or any part of it.

"On November 1st, the union coal miners went on a strike, because of which the Government commandeered and diverted all coal loaded at non-union mines and fixed price on such coal which barely cover operating costs.

"In some cases the Government agents, in charge of the matter, notified us that they confiscated and diverted our coal. We then invoiced said coal to the divertees. These invoices, for the most part, have not yet been paid. We are outstanding, as is every other coal concern, thousands of dollars on this coal. Some day we will get our money, but we know not when.

"In other and perhaps more numerous instances, our coal was simply taken and sent to various sections of the country by Government agents without any notification to us whatever, and we had no knowledge of the facts until asking our customers to pay for coal, many of whom, by the way, were Canadians. We learned that they had not received it, and we have thousands of dollars tied up in this manner and in coal for which we do not know to whom invoices should be rendered, and will not know until we go through the tedious process of tracing these cars individually, which will take weeks and months.

"The coal industry, by reasons of conditions above explained and also reasons which follow, is so extremely short of ready funds, that the financing problem is one which requires vigilant and constant attention. Understand, we are not allowed interest on our money tied up as above explained, in diverted coal, but we have to pay interest on loans from the bank and money borrowed to conduct our business in this emergency.

"The Government, as above explained, on current shipments are allowing the mines a meagre profit, so that it barely covers expenses, while to the wholesale jobber they allow only a gross margin of 15c per ton.

"Further, by reason of the run-down conditions in which the railroads now find themselves after between two and three years of Government control, the equipment is wholly inadequate and they are giving the mines only 40 to 50 per cent. car supply, so that they are running only approximately one-half time, thereby greatly increasing our overhead expense per ton produced, while they still are allowed only the Government maximum price which was based on costs figured on 100 per cent. production.

"Taking these things into consideration and the fact that from our standpoint as wholesalers, we only make 15c per ton, no matter what the cost price of the coal may be, you can readily see that there is nothing left after we pay our ordinary expenses, and that we would have a loss if we undertook to assume the exchange rate or any part of it. For example:—We make 15c per ton on coal that costs $3.00 per ton at mines. On basis of the present exchange rates if we were to assume same it would cost us about 48c per ton. To-day's rate is 16 per cent.

"We have gone into this matter at length because we fully appreciate that our Canadian trade, who not understanding the conditions affecting our business, are inclined, in many instances, to feel that we should protect them on the exchange rate either in whole or in part."

From the high prices of the year the aggregate market value of the common stocks of 20 leading industrial corporations has slumped approximately $560,000,000. A Wall Street compilation puts the combined market value of these stocks at the recent highs at $2,662,966,346. That figure is now around $2,100,000,000. That gives an idea of the extent of the decline in Wall Street security values. This does not take into consideration the fall in railroad stocks, in Liberty bonds, in railroad bonds, in fact, in all issues. General Motors common stock has slumped close to $250,000,000 in market value from the high price of 1919. This stock is not included in the 20 used in the compilation.

BY THE time a young man figures out the cost of a kitchen table, and stove, and a few sticks for the dining-room and bedroom, and still persists in the drift of matrimony—let us arise and shout: "There is a man!"

THE head of a New York grocery concern says prices will stay up for two years yet. If that chap ever predicted anything else he'd lose his job as the drum major in the grocery league.

A MAN who slants toward figures reckons it costs $1 a week to keep a house cat now. That makes $52 purr year.

BRICKLAYERS in Windsor get $1.25 per hour now. All of which will mean that the average house will now sprout a mortgage about as high as the gable window.

The Old Actor—"I'm afraid I'm past playing the hero; but it's something to know that I will have a star part as the villain."
Partridge in "Punch" (London).

MARKET DEVELOPMENTS

Price Increases Are as Frequent as Ever

High Speed Cutters and Carbon Drills Are Listed Higher This Week—Tin is Going Up Following the Trend of the London Market—Premiums Asked on Several Lines

THERE is a feeling that, although deliveries are not improving, an' improvement will come before long in the steel situation. It cannot arrive any too soon for a large number of Canadian consumers. Shortage is just as acute in United States, and it is worth noting that a number of American buyers have approached Canadian mills to see if it would be possible to secure any tonnage here.

A survey of the whole situation leads one to believe that the much-talked-of runaway steel market is not going to materialize. That does not mean that prices are not soaring. They are, but the United States Steel Corporation is still adhering to the March 21 schedule and making deliveries at that price. The premium-getters have left that price list. In fact, there is plate business being placed from Toronto at a base price of four cents per pound, against the old market figure of 2.65. The trade will pay the price now if the material can be delivered. Blue annealed sheets are being brought in at a premium that will cause the jobbers to quote nine cents per pound, which is a pretty fair price for this material.

Prices have also advanced in high-speed cutters and carbon drills made in Canada.

The fact that a firm of machine tool-makers increased their prices causes little thought in the machine tool dealers' premises now. It used to be something to talk about, but now it is accepted as one of the commonplace things of the day.

The purchases of the Canadian Pacific and the Canadian National roads have put a lot of business on the books of steel and iron firms, as some of the shops were not fully covered.

The price to which tin is soaring, following the lead of the London market, is the feature of the non-ferrous trade. Jobbers are asking 77 cents at this writing, and some of them are predicting that it will touch one dollar before it stops.

MONTREAL GETTING BETTER DELIVERY FROM THE OLD LAND

Special to CANADIAN MACHINERY.

MONTREAL, March 4.—While business in the aggregate does not seem to have suffered from the complex character of finance, there is an apparent indescribable influence affecting general activity in commercial and industrial circles. The transfer of the American railroads back to their former owners has created a temporary lull in trade in the States. It is generally believed here that the change will eventually mean an extensive refitting programme on the part of all or many of the roads. The administration of that section of the Grand Trunk which has been under the jurisdiction of the U. S. Government has again been transferred to the head office in Montreal and reorganization plans may involve the purchase of considerable rolling stock and other equipment. Heavy buying of cars has recently been contracted for by Canadian roads, and extension of plant and shop equipment is awaiting more favorable conditions in the matter of exchange.

Firmer Metal Market

There is a tendency in the metal market for higher prices. The financial difficulties that surround present trading is a factor that makes the situation one of marked uncertainty. The volume of business that is passing is, on the whole, satisfactory, but of a conservative character. Wherever possible, buying is done on this side of the line, and Canadian producers have benefited by the prevailing rate of exchange. Coppers are firm, with lake ½ cent easier at 25 cents per pound. Tin movement is not active but price quotations reflect the abnormally high figures that prevail in London. Local dealers are asking 77 cents per pound. Recent demand for lead has caused an advance in price and the quotation of 12 cents per pound. Antimony at 14½ cents is ½ cent stronger, and 34 cents for aluminum shows an advance of 1 cent over last week.

Better Delivery From England

From all reports the factor of exchange is still a deciding condition in the buying of machinery from the States, although the situation has lost some of its former oppressiveness by the attitude of many American manufacturers in providing means whereby the burden of the high exchange is distributed between the seller and the buyer. This arrangement has given some relief to the situation, but there is still a conservative policy practised by Canadian users of machine tools that must be purchased from the States. A feature that is worthy of mention is the tendency of Canadian buyers to patronize English made tools, and if delivery was assured it is believed that heavier machine trade would develop in this direction. As a matter of fact the receipt of material or goods from England is invariably more definite than similar goods coming in from the States. One dealer here stated that on a certain line of drilling machine brought in from the States the delivery was promised in "approximately" six weeks, while "definite" delivery was promised on a similar machine coming from England.

Old Materials are Higher

The old material situation has taken on strength, and prices quoted are from 1 to 2 cents per pound higher than those generally ruling for the past several weeks. The most notable advance has been in machinery cast and the average price the dealer is paying is about $32 per ton, this representing an advance of $6 per ton. A steady volume of business is carried on in most lines but the question of exchange has changed the market a little, inasmuch as steel and iron scraps going to the States are a little heavier, but the local consumption of metal scraps, particularly copper, has increased owing to the high cost of American ingot copper at the present time. The strength of the ingot market has been reflected in scrap and higher prices are effective. Dealers' present average buying prices are shown in the selected market quotations, and the average advance is about ½ cent per pound.

PREMIUMS FIGURE IN MANY DELIVERIES

Small Improvement Seen in Amount of Material Being Delivered—Increases in Small Tool Prices

TORONTO.—There is every indication that business is going to remain very satisfactory in the machine tool, supply and steel business for some time to come. Inquiries are coming in showing that new lines are being developed in different industrial centres. All this means that they are or will be in the market for machine tools and supplies, also for raw material.

Although the list of American firms that are arranging to assist their Canadian trade in exchange matters is increasing, one hears less about the matter as the weeks go by. The trade as a general thing takes it as a matter of fact that the exchange rate is simply added to the purchase price and the consumers are paying it and passing it on the ultimate buyer. A good many purchasing agents, though, are making an attempt to adhere to the plan that they are going to spend their dollars where they are recognized as whole ones. Against this there is a noticeable attempt in some quarters to get as much material as possible into the United States market as the sellers find it very much to their advantage to get payment in New York funds. In other words the sellers are pleased and the buyers are not.

Cannot Get the Machines

There are dealers in machine tools who have to sit back and see nice orders pass right before them. They are unable to do the one thing necessary, viz., deliver the machine in anything approaching the specified time. One case: A Toronto dealer got a nice piece of Montreal business for 60-day delivery. His house told him that three months would be the best they could do, so the business passed to another Eastern salesman, who took a machine in transit for another customer and supplied the man who was urgent. Now the first customer wonders when his machine will arrive, not knowing that his machine is turning out work in another shop. This is an isolated case as dealers do their utmost to come as close as possible to deliveries.

POINTS IN WEEK'S MARKETING NOTES

Pittsburgh believes that there is more stability to the steel market this week than has been shown for some time, and that the threatened runaway has been held in check largely because the Steel Corporation adhere to the old schedule of March 21.

New York says that the machine tool trade is not very brisk, because foreign buying has fallen off to a great extent owing to the adverse exchange.

The scrap metal dealers are making quite a noticeable effort to get as much material in the United States market, in order that they may sell and get the advantage of the exchange, which makes up for the comparatively low prices offered there now.

The Canadian trade is speculating whether, with the U. S. roads turned back to the private owners, they will get any better service in regard to shipments from the other side of the line.

Blue annealed sheets, bought at premiums, are coming on the market in Toronto, and the price will be 9c per pound, a fairly high figure.

Increases are announced in Canadian carbon drills and Canadian high speed cutters. Drills used to be 40, 10 and 5 off and are now a straight 32 per cent. off. Cutters were net to ten off, and are now quoted at net to plus ten.

Orders have been booked from Toronto district for plate at 4c per pound, against the March 21 schedule price of 2.65.

An effort is being made by American buyers to secure tonnage from the Canadian steel mills.

It is a poor day's mail coming to a machine tool dealer that does not announce a 10 per cent. increase in some line or other. It has come to be regarded as quite ordinary, and the out of the ordinary thing is a line that remains without an increase being announced.

Small Tools Increased

It was intimated in these columns last week that there was an increase coming through in carbon drills and in Canadian high-speed cutters. The new figures are in the hands of the dealers and they amount to a fairly stiff increase. Carbon drills have for some time been selling at 40, 10 and 5 off the list. This is done away with now and the new price is 32½ per cent off. It works out this way on the basis of $100. Forty off makes $60. Ten off leaves $54, and 5 off that leaves $51.30 as the actual price with all the discounts allowed under the old figure. In the new list, when a straight 32½ is allowed it brings the sale price to $68.50, or an increase of $19.80 on the basis of a $100 purchase. Canadian high-speed cutters are also changed from net to ten off to net to plus ten. The range in prices is given that way because it is understood, of course, that the price varies somewhat, depending on the extent of the purchase. In the past the large buyer has been getting ten off the list, while in future he will pay net list. The small buyer will pay list plus ten instead of net list.

Asked for an explanation of the increases, one dealer who handles a large volume of trade in this district stated that the makers had been selling too low for some time and had cut prices below the margin where they could make a profit on their operations. He went on to state that under the present arrangement the Canadian consumer was paying about the same for Canadian high-speed cutters now as the American manufacturer is paying for American made high-speed cutters.

There is a nice amount of business moving in the small tool field, not one of the dealers seen this week admitting that he was not perfectly satisfied with what was coming his way.

Some Steel Arriving

There is, if anything, a slight improvement in the amount of steel that is arriving at the Toronto warehouses this week. One firm has invoices showing a good tonnage of sheets on the way. These were secured from a premium mill and will in consequence carry a pretty fair price by the time they pass out to the trade.

There are isolated cases of 9.50 being offered at the mills for sheets. Of course these incidents are not given as showing the market prices but simply indicating how scarce some lines of material are and how anxious manufacturers are to secure supplies. It is understood that buyers from the States have approached Canadian mills several times to see if there were any chances of them getting on the order books. One report has it that inquiries from as far as 'Frisco have come in for this purpose.

Premiums are still being asked for plate with any chance for a ready delivery. One Toronto dealer was asked to pay 4 cents at an American mill when the price was still 2.65 at most of the mills. He replied that he considered the price was unwarranted and that a 4 cent price would make the figure too high for the trade here. Add duty, war tax, exchange, and freight, and it would cost 5.60 to put this plate in a Toronto warehouse. That would mean 7 cent plate for resale. The mill came back with an answer a few days ago which said that the best justification of their price was that a number of orders had been placed from Toronto at the 4 cent rate. Warehouses are not very keen to admit that they are paying that much premium, but they must be coming pretty close to it in a number of cases otherwise they would stand small chance of getting any delivery unless their business had been placed months ago, and it must be remembered that placing business a few months ago was not a favorite occupation.

The large orders that the National Railways have placed with Canadian plants in the last few days will mean a bigger demand for many lines of steel. Some of the companies that have accepted these tenders are fairly well protected, but in other cases they will have to come into the market for large tonnages.

Scrap Business Better

Dealers state that there is quite a decided improvement in the general tone of the scrap metal market. Apparently some of the yards have become weary of holding on to brass and copper, for there is quite a volume of this being offered now. In one place about 500 tons was offered during the week, which is a very fair amount for this district.

Cast iron and stove plate continue very scarce. Speaking of the prices of these two lines the firm that corrects the prices for CANADIAN MACHINERY each week stated this morning: "Any figure that we could give you on cast iron and stove plate would be more or less nominal. Show us a fair tonnage in either of these lines and we will soon come to terms with the man who has it for sale at figures well above the quotations in your paper."

There is quite a marked tendency on the price of a good many dealers to get as much stuff as possible to the United States market to take advantage of the exchange. Prices are not particularly good, but this is more than offset by the favorable exchange rate for any who have bills coming to them in United States funds.

HOW PRICES GROW IN OLD COUNTRY

Increases Very Pronounced and They Occur in Several Lines

Advices from the Old Country show how prices are increasing in the iron and steel field.

The advance in railway rates has led to Scotch steel-makers raising their prices for steel ship-plates and all sectional work by 25s. to 30s. per ton. Ironmasters, in turn, have advanced their price for pig iron for export to £11 and £11 5s. per ton, and £11 12s. 6d. for hematite, f.o.b. steelworks.

It is now possible to give the new Sheffield quotations for iron and steel. The advances are, approximately: Pig iron, 15s. to 20s.; billets, 30s. to 35s.; iron bars and hoops, 30s.; manufactured steel, 30s. to 40s.; wire rods, £3 to £3 10s. A comparison with the last pre-war year (1913) will enable one to realise how enormous has been the rise of values: Derbyshire foundry pig iron, £10 2s. 6d., against 54s. 8d.; East Coast hematite, £11 10s., against £3 10s.; bar iron, £24 10s., against £8; basic billets, £19, against £5 15s.; Bessemer acid billets, £21 15s., against £7; Siemens ditto, £22 5s., against £7 10s.

U.S. ROADS COUNTED ON TO DO BUYING

Returned to Private Owners and It is Expected They Will Seek Equipment Now

NEW YORK, March 4.—Machine-tool business in the last two weeks has not been up to the mark established in January and early in February. Taking stock of the situation, dealers and factory representatives note a falling off in both inquiries and orders, but the lull is by no means momentous, there still being a fair volume of business.

With the return of the railroads to private ownership there is bound to be considerable demand for equipment for car repairs. In the past week there have been numerous inquiries for second-hand plate-working machines, which can be had for prompt delivery.

The Willys Corporation, Elizabeth, N.J., continues to buy for its automobile plant, its latest purchase being about $150,000 worth of multiple spindle drilling machines.

Export trade in machine tools is not large on account of the foreign exchange situation, but some orders are being placed. A Japanese exporting firm has bought about $75,000 worth of tools, and a Mexican iron works has bought about the same quantity for making repairs to oil tanks, ships, etc.

THE UNCERTAINTY IS BEING TAKEN FROM THE STEEL PRICE SITUATION

PITTSBURGH, March 4.—Steel market skies are beginning to clear, and consumers of steel products are obtaining ideas as to prices they will have to pay for future supplies, the prices running far less to extremes than was prognosticated a few weeks ago. In other words the "runaway" in the steel market is proving to be rather a tame affair. While the steel producers may attempt to claim credit for preventing a runaway, they would experience difficulty in explaining why they have waited until now to name prices to regular customers for second quarter deliveries instead of selling a few weeks ago when buyers were so anxious to cover and when stabilizing influences were so needed. The Steel Corporation, indeed, sold for the present half year, not a few weeks ago, but in November and December. The corporation's policy remains that it will adhere to the March 21 or Industrial Board prices. While the shares of the Steel Corporation may have declined on the Stock Exchange in the past fortnight the stock of the Steel Corporation management has gone up in trade circles, where the wisdom and courage of the management in sticking to the old steel prices is receiving considerable more commendation than a couple of months ago.

Wall Street "News"

So called "news" circulated in Wall Street is not usually a good guide for men in the steel trade, but by careful analysis some good may be derived from what is there circulated. Of particular interest are statements recently published in the financial organs, with earmarks of being inspired by the trade to the effect that "reports from Pittsburgh" that the steel market is not in as strong a condition as was supposed are altogether wrong, and that it makes no difference anyhow, because practically all the steel producers are sold up very far ahead. Except with respect to the Steel Corporation, which is sold up far ahead because it has adhered to very moderate prices, nothing could be further from the truth. For weeks past it has been a matter of comment in steel trade circles how little actual tonnage of actual orders the independents have on their books, and when a precisely opposite statement is made, the fact is worth noting. The condition of the independents as to small order books arises thus. less uniformity, as one large independents, those who sought the highest prices obtainable, and thus were able to sell at such "premium" prices, only for early deliveries, and those who followed a pseudo-conservative policy of not advancing prices but at the same time of not selling at all. They were waiting for a time when they might be able to announce greatly advanced prices and still not become unpopular with their customers, the customers being better satisfied to be able to buy at the greatly advanced prices than not to be able to buy at all.

Second Quarter Prices Announced

The more conservative of the latter class of independents are now naming prices to customers for second quarter, and while the prices represent very substantial advances over March 21 Industrial Board of Steel Corporation prices, they are not "runaway" prices by any means, nor are they at anything like the level of prices that have been obtainable for small lots for early delivery. On merchant bars the price now quoted by several important independents for second quarter settlements is 3.00c, while on shapes the price is 3.10c. These two prices are each $2 a ton above the war control prices and $13 a ton above the March 21 prices. On plates there is less uniformity as one large independent has named 3.25c for second quarter shipments to regular customers, which is just equal to the war control price and is therefore $12 a ton above the March 21 price, while some others are asking about 3.50c. For early deliveries bars have been commanding as high as 4.00c, while plates have been bought rather freely, though in relatively small lots, at 4.50c. Consumers are accepting these prices as just put out and specifying for second quarter, but there is little if any disposition to cover at them, for third quarter or second half.

Automobile Trade Domination Renounced

Among the rank and file of steel buyers there is in progress what may be described as a revolt against automobile trade domination of the steel market. That trade has been lavish in its expenditures and has freely bid up prices, apparently being interested solely in deliveries and not at all in the cost of materials. The condition has applied not only to steel but also to lumber, plate glass, and some other commodities. Ordinary buyers of materials are willing to admit that the automobile industry is an important one and that the people would have to quit living if they did not get a few million automobiles more every year, but they are unwilling to admit that they have to pay as high prices as the automobile trade will pay when that trade can consume only a small fraction of the total output of steel, lumber, glass, etc.. The automobile industry may possibly use up to about a quarter million tons of steel a month, but the steel industry's capacity is more than three million gross tons of finished rolled steel a month. The agricultural implement makers, the railroads, and other industries hitherto regarded as contributing to the country's prosperity, cannot and will not bid against the automobile trade when it bids such fancy prices.

For illustration, about four weeks ago sheet bars sold at the then new record price of $65, the buyers purchasing for the purpose of having the bars converted into sheets by conversion contracts with sheet mills. Such conversion contracts can be made on moderate terms because some of the sheet mills, including even the Steel Corporation sheet subsidiary, have idle rolling capacity through being short of steel. Then, less than a fortnight ago, $70 was similarly paid for sheet bars, and a few days ago $80 was paid for 1,000 tons of open-hearth bars, $75 being paid for 1,500 tons of Bessemer. Ordinary consumers of sheets simply can have nothing to do with such a market, when this $80 price compares with $42 by the March 21 schedule and less than $26 as the ten-year pre-war average price of sheet bars, and essentially they are in revolt, waiting for this thing to blow over.

Transportation Still Poor

On the whole, transportation conditions are still poor, and it is now the common belief that general relief will come only with the advent of milder weather, the winter having been unusually severe and prolonged. A month ago the Carnegie Steel Company had between 150,000 and 160,000 tons of its finished products piled, on account of car shortage, and this accumulation has now been cut in half, but on the other hand the American Sheet & Tin Plate Co.'s accumulation has grown to about 50,000 tons, equal to approximately ten days' production. A third subsidiary of the Steel Corporation, the National Tube Company, has been operating at an average of over 90 per cent. of capacity since the first of the year, yet has been able to ship its product as fast as made. Accordingly there is no general rule. Car shortages are a local matter, depending not so much upon the general supply of cars and locomotives, as popularly assumed, but rather upon yard and terminal facilities, which need much expansion, particularly in certain districts.

As to coal car supplies, the condition of the past ten days is reported as the worst yet, but little actual curtailment in steel production results, there being rather a prevention of the expansion in output that would otherwise occur.

First Drop in Pig Iron

For several months pig iron has been going exclusively one way, and at a rapid pace. In the past few weeks some have been predicting $50 pig iron, and some still higher prices, while a few producers expressed the opinion that the top had been reached and did not conceal their satisfaction that such was the case.

Basic pig iron had been pushed up to $43 valley, with some important sales made at that figure, but a few days ago a producer sold a round tonnage of prompt at $41.50, valley basis, and that is now the quotable market. This may possibly mark a general turn in pig iron.

PURCHASING AGENTS WILL INSIST ON 100 CENTS FOR THE CANADIAN DOLLAR

The Purchasing Agents' Association of Toronto, affiliated with the National Association of Purchasing Agents of New York, and representing a buying power of over $100,000,000, passed the following resolution at their meeting held in the King Edward Hotel last night:

"That, owing to the abnormal rate of exchange now prevailing between Canada and the United States, the Toronto Purchasing Agents' Association are resolved to favor wherever possible those firms who, appreciating these conditions, agree to relieve the situation by accepting Canadian funds in payment of our purchases."

Copies of this resolution will be sent to the National Headquarters in New York and to United States firms doing business in Canada. Copies will also be sent to the Minister of Finance at Ottawa and to the Bankers' Association. It is expected that the Ottawa and Montreal Associations will take similar action.

Mr. A. B. Kerr, who addressed the meeting, was of the opinion that many United States firms were adopting a policy of drift. "The exchange situation has reached such serious proportions that it is time for drastic action, and we should do everything within our power to correct an intolerable situation," said Mr. Kerr. "If United States firms are unwilling to accept Canadian funds in payment of our purchases, then we would suggest three alternatives. Let them either open a Canadian bank account, accept payment in war bonds, or take long-term notes."

"A long list of United States firms have signified their willingness to open Canadian bank accounts; others have notified their Canadian customers that they will accept fifty per cent. of the exchange. It is the firms who will not make any concession that must be brought into line by some concerted action."

Mr. W. S. Leckie, of the Government War Purchasing Department at Ottawa, also addressed the meeting, and referred to the present difficulty the Government had in doing business with United States firms, owing to the high rate of exchange.

The following officers of the Association were nominated for re-election: J. I. Nicholson, Gunns Ltd., president; W. F. Dodd, Canadian Kodak Co., vice-president; G. P. Beswick, secretary; W. McG. Brown, Brown's Copper and Brass Rolling Mills, treasurer.

BIG ORDERS GIVEN BY THE C.N. ROAD

Particulars of Where the $25,000,000 Business Has Been Placed

EQUIPMENT orders involving an expenditure of approximately $25,-000,000 have been placed by the Canadian National Railways. An announcement was made by the Canada Car & Foundry Company, of Montreal last week that orders aggregating $7,000,-000 had been placed with that company by the C.N.R. and $5,000,000 by the C.P.R. It was stated at the same time that other orders on the company's books would bring the grand total of business on hand to fully $20,000,000.

The Canadian National Railways' placements are as follows: Canadian Locomotive Co., Kingston, Ont., 45 locomotives; Montreal Locomotive Works, 67 locomotives; Canadian Car & Foundry Co., Montreal, Que., 18 sleeping cars, 12 dining cars, 20 baggage cars, 1,000 box cars, 600 refrigerator cars, 80 cabooses; Eastern Car Co., Trenton, N.S., 500 box cars, 1,150 coal cars, 6 snow plows; National Steel Car Co., Hamilton, Ont., 1,500 box cars; Preston Car & Coach Co., Preston, Ont., 20 cabooses; Hart-Otis Car Co., Montreal, Que., 350 ballast cars.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$42 40
Lake Superior, charcoal, Chicago	57 00
Standard low phos., Philadelphia	50 00
Bessemer, Pittsburgh	43 00
Basic, Valley furnace	40 00
Toronto price:—	
Silicon, 2.25% to 2.75%	52 00
No. 2 Foundry, 1.75 to 2.25%	50 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 00
Steel bars, base, Toronto	5 00
Iron bars, base, Montreal	5 00
Steel bars, base, Montreal	5 00
Reinforcing bars, base	5 00
Steel hoops	7 00
Norway iron	11 00
Tire steel	5 50
Spring steel	8 00
Band steel, No. 10 gauge and 3-16 in. base	5 25
Chequered floor plate, 3-16 in.	8 00
Chequered floor plate, ¼ in.	7 50
Staybolt iron	9 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	4 00
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 90
Small shapes under 3"	3 62

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St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

	Gross. Montreal	Toronto
Lake copper	$25 00	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	77 00	78 00
Spelter	12 50	12 00
Lead	12 00	12 00
Antimony	14 50	14 00
Aluminum	34 00	35 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	6 50	7 25
Plates, ¼ up	$ 6 00	$ 6 50

Price List No. 38

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Standard Buttweld

⅛ in.	$ 6 00	$ 8 00
¼ in.	4 68	6 81
⅜ in.	4 68	6 81
½ in.	6 21	7 78
¾ in.	7 82	9 95
1 in.	11 56	14 71
1¼ in.	15 64	19 90
1½ in.	18 70	23 76
2 in.	25 16	32 01
2½ in.	40 87	51 19
3 in.	52 79	66 94
3½ in.	67 16	84 18
4 in.	79 57	99 74

Standard Lapweld

2 in.	38 81	35 34
2½ in.	42 12	52 36
3 in.	55 08	68 47
3½ in.	69 00	86 94
4 in.	81 75	103 00
4½ in.	93	1 18
5 in.	1 08	1 37
6 in.	1 40	1 78
7 in.	1 83	2 32
8L in.	1 93	2 44
8 in.	2 22	2 81
9 in.	2 66	3 36
10L in.	2 46	3 12
10 in.	3 17	4 02

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4½" and larger 50%.
4" and under, running thread, 30%.
Standard couplings, 4" and under, 40%, 4½" and larger, 20%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$15 00	$13 75
Copper, crucible	18 00	17 00
Copper, heavy	18 00	17 00
Copper wire	18 00	17 00
No. 1 machine composition	16 00	16 00
New brass cuttings	11 00	10 75
Red brass cuttings	14 00	14 75
Yellow brass turnings	8 50	9 00
Light brass	6 50	7 00
Medium brass	8 00	7 75
Scrap zinc	6 50	6 00
Heavy lead	7 00	6 00
Tea lead	4 50	3 50
Aluminum	19 00	18 00
	Per Ton	Gross
Heavy melting steel	18 00	16 00
Boiler plate	15 50	11 00
Axles (wrought iron)	22 00	20 00
Rails (crap)	18 00	16 00
Malleable scrap	25 00	20 00
No. 1 machine cast iron	32 00	25 00
Pipe, wrought	12 00	9 00
Car wheels	22 00	20 00
Steel axles	22 00	20 00
Mach. shop turnings	11 00	11 00
Stove plate	25 00	21 00
Cast boring	12 00	11 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜" and less	15
Carriage bolts, 7-16 and up	Net
Coach and lag screws	30
Stove bolts	50
Wrought washers	50
Elevator bolts	5
Machine bolts, 7-16 and over	10
Machine bolts, ⅜" and less	20
Blank bolts	25
Bolt ends	10
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square blank	add $1.50
Nuts, square, tapped	add 1 75
Nuts, hex., blank	add 1 75
Nuts, hex., tapped	add 2 00
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R.. bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	40
Sq. and Hex. Head Cap Screws	35
Rd. and Fil. Head Cap Screws	5
Flat But. Hd. Cap Screws	10
Fin. and Semi-fin. nuts up to 1 in.	35
Fin. and Semi-fin. nuts, over 1 in., up to 1½ in.	25
Fin. and Semi-fin. nuts over 1½ in., up to 2 in.	10
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$60 00
Open-hearth billets	60 00
O.H. sheet bars	76 00
Forging billets	56 00-75 00
Wire rods	52 00-70 00

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NAILS AND SPIKES

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Cut nails	5 85
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

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Cotton rope, ¼-in. and up	0 80

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CANADIAN MACHINERY
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The Helical Gear, Its Design and Application

The First Portion of a Treatise Covering the Application of Helical or Twisted Teeth to Gears Operating on Parallel Axis, Together With Data on Design, Application and Production

THE helical gear differs from an ordinary spur gear in five essential points:

First, contact of the teeth of a helical gear is progressive, starting in at one end of a pair of teeth, then a little further in from the end, then a little further still, and so on, until the end of the tooth is reached, and by this time the next pair of teeth should be making contact at the other end. This is known as "continuous helical action."

Second, owing to the overlapping of the teeth, the action is much smoother and therefore much quieter than a spur gear.

Third, as there is always more than one tooth in action, the helical gear possesses greater strength over that of a spur gear of the same pitch, pressure angle and tooth form.

Fourth, owing to this increased strength it is possible to reduce the pitch of a helical gear over that used for a spur gear carrying the same load, and this reduction of pitch gives still additional smoothness and quietness of action.

Fifth, because of the smooth action of helical gear teeth, it gives greater efficiency than the so-called straight-tooth spur gear.

These points are all of vital interest to designers and engineers.

The chief drawback to the use of the helical gear has been the complexity of the mechanism required for cutting it. The Fellows Gear Shaper Company has overcome these objections by designing a machine incorporating simplicity of mechanism and control, and the use of helical cutters, the teeth of which are generated by grinding after hardening.

Owing to the fact that the helical gear possesses so many advantages over the ordinary spur gear, and also to the fact that it is receiving considerable attention at the present time, it has been thought that an article dealing with the design, application and methods of cutting helical gears would prove of value to designers and engineers.

Principle of the Helical Gear

There is some confusion regarding the proper use of the terms "helical" and "spiral." This has come about largely because of a lack of understanding of the proper application of the terms "helix" and "spiral." "Helix" means a concentric twist, whereas "spiral" means eccentric convolutions (see Fig. 1).

Therefore, when we speak of a helical gear, we mean a gear in which the teeth are twisted with relation to the axis of the gear blank.

When we speak of a spiral gear, however, we have reference to a gear in which the teeth all lie in the same plane, such as the scroll on the face of a chuck. Therefore, the term "helix" should be applied to all forms of gear teeth which are of twisted form, whether these gears are to drive shafts at right angles or in parallel planes.

GENERAL VIEW OF A FELLOWS HELICAL GEAR SHAPER.

Helical Gears Operating on Parallel Axes

In the following we will deal with only one type of helical gear; viz., that which operates on parallel axes. The only difference between an ordinary spur gear and a helical gear operating on parallel axes is that in the helical gear the teeth are twisted with relation to the axis of the gear instead of lying in a parallel plane. The action of the helical gear, overlooking this difference in tooth shape, is exactly the same as an ordinary spur gear, as is clearly shown at A in Fig. 2.

Helical Gears Operating in Angular Relations to Each Other

Other forms of helical gears, which we will not deal with here, operate on shafts that are set in angular relations to each other (see B, Fig. 2). This form of helical gear is

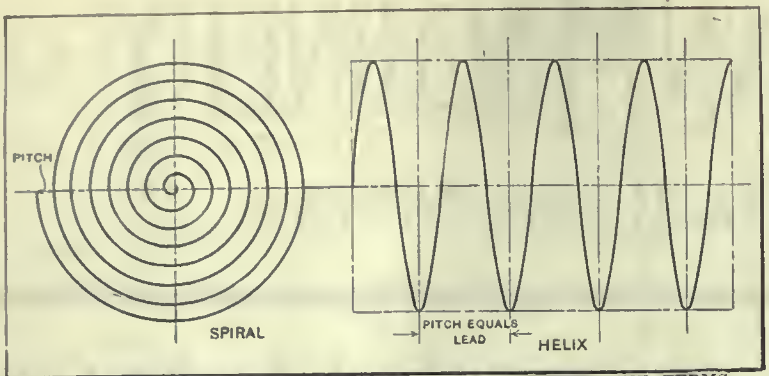


FIG. 1—DIAGRAM ILLUSTRATING DIFFERENCE BETWEEN THE TERMS SPIRAL AND HELIX.

used to drive shafts located at angular relations to each other, and is sometimes used to take the place of a worm and worm-wheel. The action of this form of gear differs considerably from the action of a helical gear operating on parallel axes, in that there is not full-tooth length contact. Theoretically speaking, there is nowhere near as much contact of the teeth on helical gears set at right angles as there is between a worm and a worm-wheel

We will in the following devote our entire attention to that form of helical gear operating on parallel axes, as its use is more general.

Herringbone Gears

The herringbone gear does not differ essentially from the helical gear, except in one feature; viz., that of having opposed helical teeth, one right- and the other left-hand. This form of gear is so constructed that the end thrust, due to the twisted shape of the teeth, is consumed within the gear itself, and hence thrust bearings are not necessary. Herringbone gears of wide face and slight helix angles give very efficient results; but narrow-faced, steep-helix herringbone gears are objectionable, as will be explained more fully later on. Herringbone gears, as shown in Table II, are made in two types; that is, with "matched" and "staggered" teeth. When the teeth are staggered, the face width need be only one-half of that necessary when the teeth are matched.

Tooth Action of Helical Gears

Helical gears operating on parallel axes give smoother action than ordinary spur gears. In a spur gear there are three distinct phases of engagement, as follows:

1. The root of the (driving) pinion engages the point of the gear tooth.
2. The teeth are in engagement in the vicinity of the pitch line.
3. The point of the (driving) pinion tooth engages the root of the gear tooth.

From this it will be seen that with spur gearing, the teeth are in engagement only at the pitch line for a small part of their rotation, so that the greater part of the load is carried by the points and roots of the teeth.

Suppose we take two spur gears and rivet them together, setting the teeth of one in advance of the other, a distance equal to one half the circular pitch. We now have six instead of three phases of engagement. By carrying this still further and using a series of laminated gears, as shown in Fig. 3, we greatly increase the number of phases of engagement; until if it were possible to use a series of laminations of infinitesimal thickness we would have continuous engagement at the pitch line.

We now have a helical gear, because if we consider the laminations of infinitesimal thickness, the pitch point of action of the gears has developed into a helix, and if this has an advance equal to the circular pitch in the face width of the gear, we have what is known as "continuous helical action." It should be understood, however, that as far as the length of the line of action is concerned, this is the same as for two spur gears of the same pitch, tooth length, etc. The essential difference between a spur and a helical gear lies in the fact that helical gears, when properly designed and cut, are always in contact at the pitch line in some one plane. As the action between gear teeth is a purely rolling one at the pitch line, it can be clearly seen that from the standpoint of efficiency, the helical gear is superior to the ordinary spur gear.

Above and below the pitch line, the teeth slip upon each other and it is for this reason that certain indeterminate shocks sometimes develop in the use of spur gears, and more especially when they become worn, so that the back lash is considerable. With contact always at the pitch line and in some one plane, as is the case with helical gears, these shocks are done away with. Furthermore since the teeth slip above and below the pitch line, more wear takes place at these points than at the pitch line, and the effect of this is to constantly throw the load to the pitch line where the action is best.

Methods of Producing Helical Gears

There are only two recognized methods of producing helical gears; viz., forming and generating. Previous to the design of equipment for generating helical gear teeth, this form of gear was always cut on a universal milling machine by using the index-head and change gears arranged to give the proper helix. When only a small number of gear are required of any one particular shape and size, this method is in some cases still used.

For the production of quiet and efficient-running helical gears, this method has several disadvantages. We need not go into them in detail, except, in so far as to say that it is difficult by this method to obtain teeth that are evenly spaced, tooth shapes that are perfect involutes, and helix angles that are duplicates.

Generating of Helical Gears

The other method of producing helical gears is by means of generating. There are several ways in which this is accomplished, but in the following we will deal exclusively with the Fellows Gear Shaper method of producing gears.

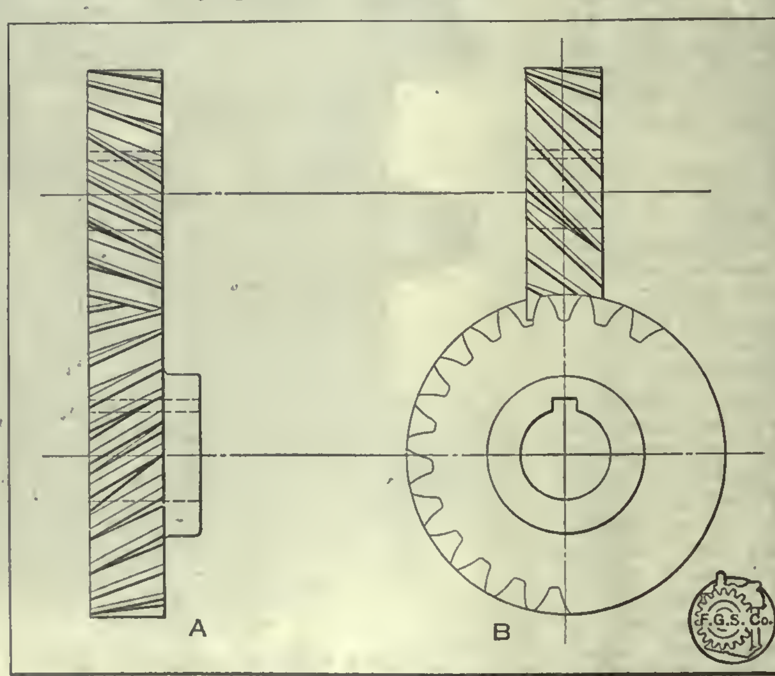


FIG. 2—HELICAL GEARS OPERATING ON PARALLEL SHAFTS, AND SHAFTS LOCATED AT RIGHT ANGLES TO EACH OTHER.

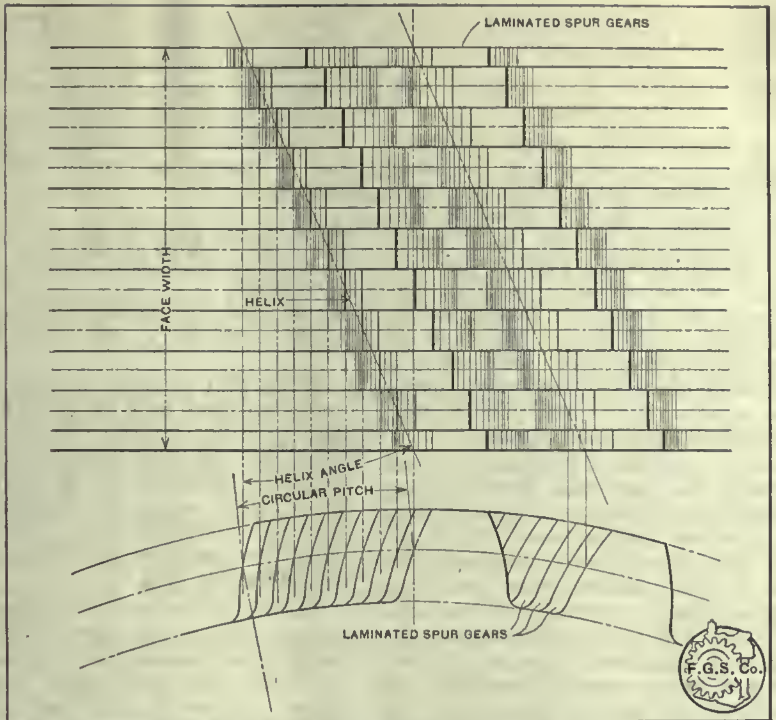


FIG. 3—DIAGRAM SHOWING HOW A SERIES OF LAMINATED SPUR GEARS WITH THE TEETH SET AT AN ANGLE GIVE THE SAME TOOTH ACTION AS A HELICAL GEAR.

In order to thoroughly understand this principle, we will refer to Fig. 4. This shows diagrammatically a helical gear in mesh with a plastic blank. Now, if we hold this plastic blank and roll the helical gear around it, we produce in the plastic blank similar helical teeth to those on the gear.

By replacing the plastic blank with an iron or steel gear blank and the gear with a helical Gear Shaper cutter, we can cut helical teeth in the blank by simply rolling the two together, meanwhile reciprocating the cutter back and forth, and at the same time guiding it in its proper helical path. This, essentially, is the principle upon which the Fellows Helical Gear Shaper operates.

Now, it should be noted in this connection that the cutter in its action on the work is not controlled in its helical path by means of a series of change gears or any other flexible device. Instead, the path, through which the cutter travels, is controlled by means of two helical guides which are exact duplicates of the helix angle on the cutter. It is evident from this that with properly machined guides it is possible to produce any number of helical gears which will have exactly the same helix angle. This is not possible when flexible devices are used. Consequently, it is easy to see that the helical Gear Shaper principle is ideal from the standpoint of accuracy.

Furthermore, we might state that the cutter, which is made from high-speed steel, is ground all over after hardening, including the involute curves on the cutter teeth, which are generated by means of a special grinding process. This removes all inaccuracies due to hardening, and produces a helical cutter which in reality is a laboratory product made in commercial quantities.

Design of Helical Gears

In designing a helical gear, it is very important to consider two things,—first, pitch and, second, helix angle. As will be explained further on, a change in the helix angle changes the so-called normal pitch, also the circular pitch, pressure angle and tooth thickness. The only possible disadvantage to the helical gear is that it creates an end thrust. This is due to the fact that the teeth are located in a helical plane and act somewhat similar to that of two inclined planes, working upon each other. With a slight helix angle, however, and a fine pitch, the end thrust is practically negligible; but when the helix angle is steep, then the end thrust becomes considerable.

Diametral and Normal Planes

There is one distinction between a helical and a spur gear which seems to confuse the average mechanic, and that is, that a helical gear can be viewed from two planes, commonly known as normal and diametral. The diametral plane of a helical gear, as shown in Fig. 5, refers to the outline of the tooth as it is viewed from a position parallel with the face of the gear. The normal plane is the shape of the tooth lying

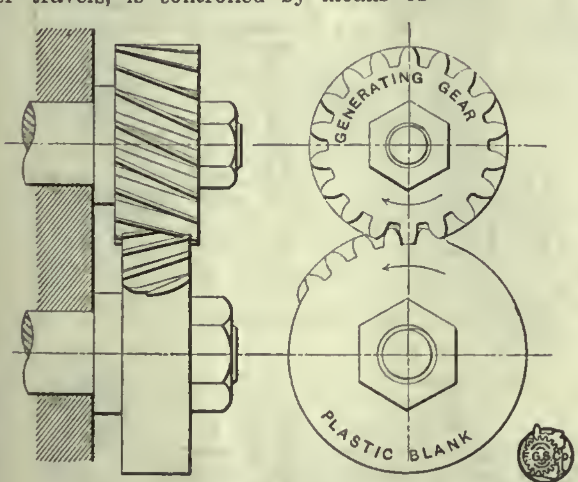


FIG. 4—DIAGRAM ILLUSTRATING THE PRINCIPLE UPON WHICH THE FELLOWS HELICAL SHAPER OPERATES.

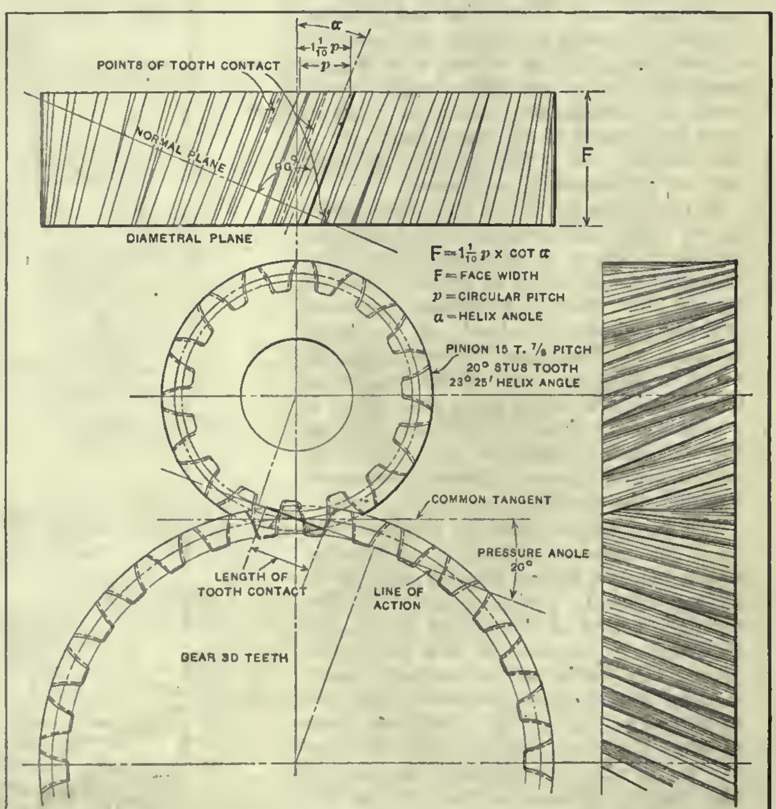


FIG. 5—DIAGRAM GIVING NOTATION OF ELEMENTS OF HELICAL GEAR TEETH.

in a plane at right angles to the helix angle of the tooth. For this reason, a helical gear tooth is always thinner on the normal plane than it is on the diametral plane; also, the pressure angle and circular pitch are less on the normal than on the diametral plane.

It is the practice when cutting helical gears by the formed cutter or hobbing process, to consider the form of the tooth as viewed from the normal plane only, and not from the diametral plane. This necessitates calculation of the tooth elements on the normal plane, and to those unfamiliar with helical gearing presents a difficult problem.

With the Fellows Gear Shaper system just the reverse is the case, a helical gear is considered in all of its essential tooth elements exactly as a spur gear. The reason for this is that the Gear Shaper cutter tooth is ground so that it is of standard tooth thickness on the diametral plane, and hence cuts a gear which is correct in every respect whether it be viewed from the normal or diametral plane. For this reason, a helical Gear Shaper cutter is essentially nothing but a spur cutter with the teeth twisted. In the helical cutter, the faces of the teeth are ground at right angles to the helix, and a rake angle of five degrees is provided on the top faces of the teeth to make them free-cutting.

Relation Between Width of Face and Helix Angle

As the width of face of a helical gear and its pitch govern the helix angle of the tooth necessary to give continuous action, it is therefore evident that there is a distinct relation between these three factors,—width of face, helix angle and pitch. With a helical gear we are not so closely limited to the selection of a certain pitch as we are with a spur gear, for the reason that a helical gear tooth is considerably stronger than a spur gear tooth of the same pitch, pressure angle, etc. The reason for this will be subsequently explained.

We can also prove by a diagram similar to that illustrated in Fig. 6, that as the helix angle is increased, the effective load on the tooth is greatly increased and that there is a certain point—45 degrees—where the load on the tooth becomes so great that the end thrust is equal to 41½ per cent. of the tangential load. It is therefore plain that there is a considerable force tending to separate the two gears, and that this separating action also imposes a greatly increased load on the tooth.

We also know that the angle of repose for metals in contact varies between ten and fifteen degrees, and as we have previously explained in connection with the action of the helical gear tooth, the load is carried on the pitch line where the teeth roll upon each other. At the same time, however, that the teeth are rolling at the pitch line, there is also slippage taking place between the point of one tooth and the root of the mating tooth, or vice versa, and this friction to a certain extent—especially when the helix angle is slight—tends to reduce the axial thrust.

Relation Between Axial Thrust and Helix Angle

It is difficult if not almost impossible to determine mathematically the exact relation between axial thrust and helix angle of helical gears. If we investigate this subject we see that friction plays no unimportant part in this connection; and as correctly designed helical gears are always in contact at the pitch line at the same time that the teeth are slipping upon each other in some other plane, it is difficult to determine exactly just what part friction plays in reducing axial thrust.

For all practical purposes we can eliminate the part that friction plays and look at the subject from a theoretical angle. Reference to Fig. 6 will show that the tangential load c on the tooth can be resolved into two components a and b. a represents the total tooth load and b the axial thrust. By the law of triangles a is secant of angle a and b the tangent. Therefore, the secant of the helix angle times the tangential load gives the total tooth pressure on the normal section: Rule No. 1; and the tangent of the helix angle times the tangential load gives the axial thrust: Rule No. 2.

Assume, for example, that we desire to find the total tooth load and the axial thrust of a pair of helical gears having a helix angle of 15 degrees and carrying a tangential tooth load of 500 pounds.

Total tooth load = secant 15 degrees $\times$ 500 = 1.0353 $\times$ 500 = 517.6 pounds.
Axial thrust = tangent 15 degrees $\times$ 500 = 0.2679 $\times$ 500 = 133.9 pounds.

If we still further increase the helix angle as shown at B and C in Fig. 6, we also greatly increase the total tooth load, and the axial thrust; until if the angle is increased to 45 degrees, the axial thrust equals the tangential tooth load and the total tooth load becomes 41½ per cent. greater than the tangential tooth load.

In addition to imposing a greatly increased load on the tooth, a steep helix angle also reduces the cross-section of the tooth on the normal plane, and hence weakens it, thus making it less capable of carrying the greatly imposed load. This can be clearly seen at D, E and F, Fig. 6, where the outlines of the

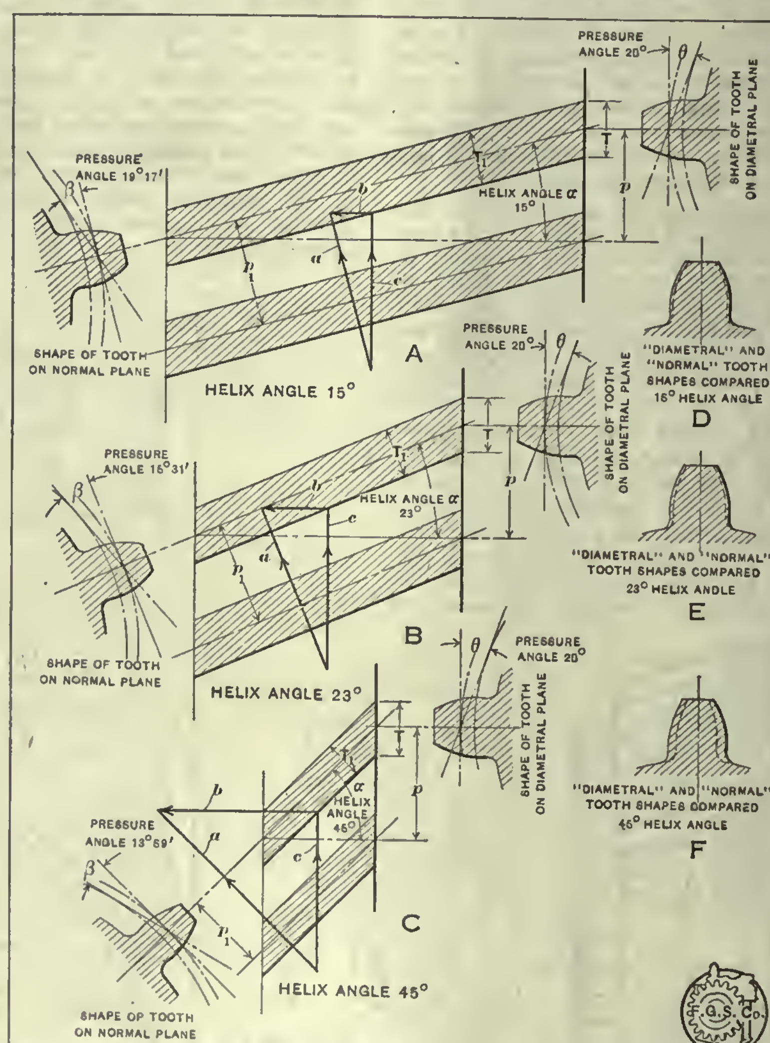


FIG. 6—DIAGRAM SHOWING HOW AN INCREASE IN THE HELICAL ANGLE GREATLY INCREASES THE AXIAL LOAD. DIAGRAM ALSO SHOWS RELATION OF ACTUAL TOOTH LOAD TO AXIAL THRUST

tooth on the normal and diametral planes have been superimposed for comparison. It is therefore evident that a moderate helix angle is to be desired in order that the axial thrust may be kept within practical limits.

Rules and Formulas for Calculating Elements of Helical Gear Teeth

There are two methods of figuring the elements of helical gear teeth. One is to calculate the elements of the teeth on the normal plane and the other on the diametral plane. For helical gears cut by the Gear Shaper method, the tooth parts can be calculated on the diametral plane in the same manner as an ordinary spur gear, thus greatly simplifying the calculations. When it is necessary, however, to change over from normal to diametral, or from diametral to normal, then certain rules and formulas have to be employed. Table I gives rules for calculating the elements of helical and herringbone gears.

Lead: The lead of a helical gear equals the pitch diameter times 3.1416, divided by the tangent of the helix angle. Rule No. 3.

Example: Assume that a helical gear has a pitch diameter of 3.5 inches and a helix angle of 23 degrees.

Then lead equals

$$\frac{3.1416 \times 3.5}{\text{Tan. 23 degrees}} = \frac{10.9956}{0.42447} = 25.904 \text{ ins.}$$

To find the tangent of the helix angle when the lead and pitch diameter are known, multiply 3.1416 by the pitch diameter and divide the result by the lead: Rule No. 4.

Example:

$$\frac{3.1416 \times 3.5}{25.904} = 0.42447 = \text{tangent } 23^\circ$$

Normal Circular Pitch (p_1): When the circular pitch (diametral) and the helix angle are known, the normal circular pitch can be found by multiplying the circular pitch by the cos. of the helix angle: Rule No. 5.

Example: Find the normal circular pitch of a 6-pitch gear, the diametral circular pitch being 0.5236 inch and the helix angle 23 degrees. Cos. of 23 degrees equals 0.9205.

$0.5236 \times 0.9205 = 0.48197$ inch, circular pitch (normal).

Circular Pitch (p): When the normal circular pitch and the helix angle are known, the circular pitch (diametral) can be found by dividing the normal circular pitch by the cos. of the helix angle: Rule No. 6.

Example: Find the circular pitch (diametral) of a 6-pitch gear, the normal pitch of which is 0.48197 inch and the helix angle 23 degrees.

$$\frac{0.48197}{0.9205} = 0.5236 \text{ inch circular pitch.}$$

Normal Diametral Pitch (P_1): When the diametral pitch and the helix angle are known, the normal diametral pitch can be found by dividing the diametral pitch by the cos. of the helix angle: Rule No. 7.

Example: Find the normal diametral pitch of a 6/8-pitch helical gear having a helix angle of 23 degrees.

$$\frac{6}{\text{cos. } 23^\circ} = \frac{6}{0.9205} = 6.5182 \text{ normal diametral pitch}$$

Diametral Pitch (P): When the normal diametral pitch and the helix angle are known the diametral pitch can be found by multiplying the normal diametral pitch by the cos. of the helix angle: Rule No. 8.

Example: Find the diametral pitch of a helical gear the normal diametral pitch of which is 6.518 and the helix angle 23 degrees.

$6.518 \times \text{cos. } 23^\circ = 6.518 \times 0.9205 = 6$ diametral pitch.

Pitch Diameter (D): The pitch diameter of a helical gear is obtained by the same formula as that used in obtaining the pitch diameter of an ordinary spur gear, Rule No. 9.

Normal Tooth Thickness (T_1): When the normal diametral pitch is known, the normal tooth thickness on the pitch line is found by dividing 1.5708 by the normal diametral pitch: Rule No. 10.

Example: Find the normal tooth thickness of a helical gear, the normal diametral pitch of which is 6.5182.

$$\frac{1.5708}{6.5182} = 0.2410 \text{ inch normal tooth thickness.}$$

Tooth Thickness, Diametral (T): When the normal tooth thickness and the helix angle are known, the tooth thickness at the pitch line on the diametral plane can be found by dividing the normal tooth thickness by the cos. of the helix angle: Rule No. 11.

Example: Find the tooth thickness on the diametral plane of a helical gear, the normal tooth thickness of which is 0.2410 and the helix angle 23 degrees.

$$\frac{0.2410}{0.9205} = 0.2618 \text{ inch tooth thickness.}$$

Normal Pressure Angle (B): When the pressure angle on the diametral plane and the helix angle are known, the tan. of the normal pressure angle is found by multiplying the tan. of the diametral presure angle by the cos. of the helix angle: Rule No. 12.

Example: Find the normal pressure angle of a helical gear, the diametral pressure angle of which is 20 degrees and the helix angle 23 degrees. Tan. 20 degrees equals 0.36397. Tan. B = $0.36397 \times 0.9205 = 0.3350$ = approximately 18 degrees 31 minutes, normal pressure angle.

Pressure Angle, Diametral (θ): When the normal pressure angle and the helix angle are known, the tan. of the actual pressure angle is found by dividing the tan. of the normal pressure angle by the cos. of the helix angle: Rule No. 13.

Rule No.	Tooth Element Wanted	Rule	Formula
3	Lead (L)	Multiply pitch diameter by 3.1416 and divide result by tan. of helix angle	$L = \frac{3.1416 \times D}{\text{tan. } a}$
4	Helix Angle (a)	Multiply pitch diameter by 3.1416 and divide result by lead	$\text{Tan. } (a = \frac{3.1416 \times D}{L}$
5	Normal Circular Pitch (p_1)	Multiply diametral circular pitch by cos. of helix angle	$p_1 = p \times \text{cos. } a$
6	Diametral Circular Pitch (p)	Divide normal circular pitch by cos. of helix angle	$p = \frac{p_1}{\text{cos. } a}$
7	Normal Diametral pitch (P_1)	Divide diametral pitch by cos. of helix angle	$P_1 = \frac{P}{\text{cos. } a}$
8	Diametral Pitch (P)	Multiply normal diametral pitch by cos. of helix angle	$P = P_1 \times \text{cos. } a$
9	Pitch Diameter (D)	Divide number of teeth by diametral pitch	$D = \frac{N}{P}$
10	Normal Tooth Thickness (T_1)	Divide 1.5708 by normal diametral pitch	$T_1 = \frac{1.5708}{P_1}$
11	Tooth Thickness Diametral (T)	Divide normal tooth thickness by cos. of helix angle	$T = \frac{T_1}{\text{cos } a}$
12	Normal Pressure Angle (β)	Tangent of normal pressure angle equals tan. of diametral pressure angle times cos. of helix angle	$\text{Tan. } \beta = \text{tan. } \theta \times \text{cos. } a$
13	Pressure Angle "Diametral" θ)	Tangent of "diametral" pressure angle equals tan. of normal pressure angle divided by cos. of helix angle	$\text{Tan. } \theta = \frac{\text{tan. } \beta}{\text{cos. } a}$

TABLE I.—RULES AND FORMULAS FOR CONVERTING FROM NORMAL TO DIAMETRAL PITCH FOR HELICAL AND HERRINGBONE GEARS.

Example: Find actual pressure angle of a helical gear, the normal pressure angle of which is 18 degrees 31 minutes and the helix angle 23 degrees.

$$\frac{0.3350}{0.9205} = 0.36397 = \text{tan. of } 20°$$

Owing to the twisted shape of a helical gear tooth, difficulty is generally experienced in using the gear-tooth caliper, in order to obtain the chordal tooth thickness and the corrected addendum. For this reason, it is always advisable to check the tooth parts of a helical gear by holding two gears on a standard testing fixture. In this way the tooth parts can be checked with relation to the centre distance, which can be obtained by measuring over the pins with a regular micrometer caliper.

The centre distance of two helical gears would be exactly the same as two spur gears of the same pitch, tooth ratio and tooth shape. The helical-gear problem can be greatly simplified by ignoring the fact that the teeth are twisted and considering it as though it were an ordinary spur gear. The Gear Shaper method of cutting helical gears is based on this principle.

Gear Shaper Standards for Helical Gears

At the present time there is no fixed standard for helical gears, but the economical production of this form of gear makes the adoption of some standard desirable. We will therefore discuss some of the factors that enter into this problem and explain why the adoption of a standard for helical gears is desirable. We will also show further on the disadvantages of a steep helix angle, especially from the standpoint of increased end thrust and decreased strength.

Before the introduction of the helical Gear Shaper, the only practical means of cutting helical gears was by the hobbing process. The standard spur gear hobs were made to cut diametral pitches and because of convenience it has become common practice to use the same hob for cutting helical gears. The result is that if a 6-pitch hob be adjusted to feed at the necessary angle to cut a helical gear, it cuts a 6-pitch gear only when measured on the normal section (see Fig. 5) at right angles to the helix of the tooth. Its normal pitch is 6, but measured diametrally it is something fractional, depending upon the helix angle of the tooth. The diametral pitch, therefore, changes with every change of the helix angle.

It, therefore, comes about that in many cases with helical gears all of the advantages of the diametral-pitch system have been discarded and the normal pitch with its attendant complications of calculations has been substituted. The Gear Shaper system, in which the helix angle is fixed, lends itself particularly well to the cutting of diametral pitch gears, and because the helix angle is never adjusted, the relation between the pitch and the number of teeth is fixed, as is the case with spur gears; for this reason the use of the normal pitch disappears. We have explained in a previous paragraph what it meant by the normal pitch, also how it is possible to calculate the tooth section on the normal plane, when such is desirable.

For helical gears The Fellows Gear Shaper Company has adopted the stub-tooth as its standard, and two leads giving one turn in 41.207 inches and 25.904 inches respectively. Table II gives a list of the pitches and angles for which standard right and left-hand helical cutters are made. Two standard helical guides have been adopted, as previously stated, and these give approximate helix angle of 15 and 23 degrees, respectively. The reason for the slight variations in these angles for the various pitches is due to the fact that with a nominal pitch diameter of 3½ inches (which is the approximate pitch diameter of all helical cutters) it is not always possible to get a whole number of teeth in the cutter, so that the pitch diameter has to be either larger or smaller. This, of course, changes the helix angle slightly when a standard lead is used.

For example: 4, 6, 8 and 10 pitch, etc., when multiplied by a pitch diameter of 3.5 inches gives a whole number of teeth such as 14, 21, 28 and 35 teeth in the cutter; but 5, 7 and 9 pitch do not give a whole number of teeth, so that for these particular pitches we increase the pitch diameter. This changes the helix angle slightly.

For the information of those to whom this subject appears difficult, we have prepared a diagram, which is illustrated in Fig. 7. This shows why, with the same lead and an increase in the pitch diameter, the helix angle becomes greater.

At A we have a pitch diameter of

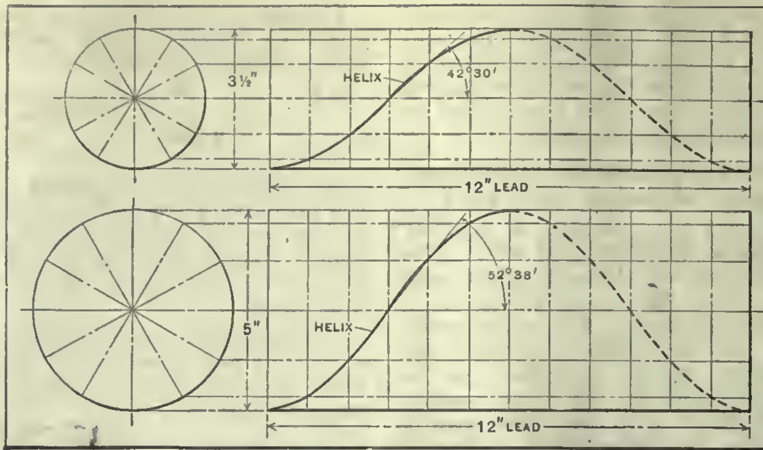
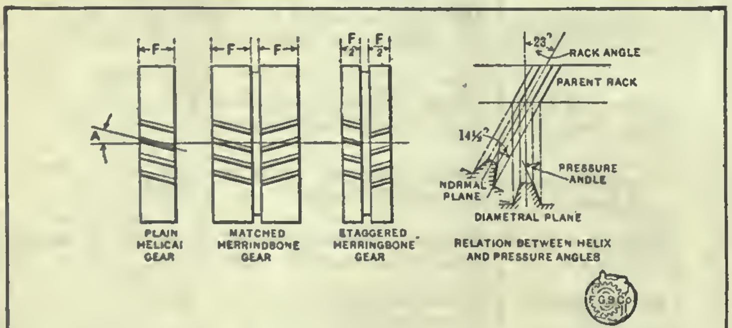


FIG. 7—DIAGRAM SHOWING HOW CHANGE IN PITCH DIAMETER WITH THE SAME LEAD PRODUCES A DIFFERENT HELIX ANGLE.

The Fellows Gear Shaper Company Standard



Diametral Pitch	Normal Pitch	Helix Angle "A"	Lead of Helix in Inches	Minimum Width of Face "F" in Inches
5/7	5.184	15°–20′	41.270	2 19/64
5/7	5.456	23°–35′	25.904	1 7/16
6/8	6.209	14°–55′	41.270	1 31/32
6/8	6.518	23°	25.904	1 15/64
7/9	7.254	15°–12′	41.270	1 21/32
7/9	7.629	23°–25′	25.904	1 3/64
8/10	8.279	14°–55′	41.270	1 31/64
8/10	8.691	23°	25.904	15/16
9/11	9.324	15°– 9′	41.270	1 19/64
9/11	9.801	23°–20′	25.904	13/16
10/12	10.349	14°–55′	41.270	1 3/16
10/12	10.863	23°	25.904	3/4
12/14	12.418	14°–55′	41.270	63/64
12/14	13.036	23°	25.904	5/8

TABLE II.—MINIMUM WIDTH OF FACE FOR CONTINUOUS HELICAL ACTION OF HELICAL AND HERRINGBONE GEARS.

3½ inches and a lead equal to one turn of the cylinder in 12 inches. This develops a helix angle of 42 degrees 30 minutes. If we increase the pitch diameter or diameter of the cylinder, as illustrated at B, to 5 inches and use the same lead of one turn in 12 inches, we find that our helix angle is greatly increased, and instead of being 42 degrees 30 minutes, it is 52 degrees 38 minutes. We therefore see that by using the same lead, but increasing the pitch diameter, we change the helix angle.

The two standard leads previously given cover practically all requirements that are met with in the design of helical gears. When the face width is not limited to any particular dimension, a helix angle of 15 degrees is recommended, but when the face width (which for average cases should be equal to from 2½ to 3 times the circular pitch) is limited, then 23 degrees is sometimes found desirable. Helix angles greater than 23 degrees cause excessive end thrusts, and in addition impose greatly increased loads on the tooth. Table II gives the minimum face width for the different pitches and helix angles. The face width should never be less than the dimension given and preferably should be wide enough so as to give an advance in the face width equal to 11-10 times the circular pitch.

(To be continued)

Quick Action Device for Jig and Fixture Work

By ROBERT MAWSON

CASES sometimes occur when designing jigs and fixtures, that a part of the piece being held projects forward of the locating surface.

Under these conditions, if the ordinary type of screw were used, much time would be lost in moving the adjusting medium out of the way, so that the part could be removed from the jig or fixture.

It need scarcely be said that such a procedure is bad practice as it would defeat one purpose of special tools, namely, quick action.

In Fig. 1, at A, is shown a locating surface represented by a single line. At B is also shown a protruding surface which is under the surface A.

It is obvious that before such a part could be removed from the tool the screw must be drawn back past the surface B.

A quick acting device designed for such conditions as outlined, as shown assembled in Fig. 1. This is made of steel and may be hardened, if desired, with a circular body C, which is made a sliding fit in a machined hole of the jig or fixture wall.

At the rear of the circular portion is a rectangular part D, one dimension being the same as the diameter of body C. At the forward end is a circular knurled part shown at E and a threaded hole is machined through the centre of this device.

The wall of the jig or fixture casting is milled out with a slot which must be at least as wide as the longest side of the end D, and as deep as the distance A to B. The construction of this operation is shown by the section X X.

When it is desired to draw back the screw F, it is given a slight turn to the left (the screw being right hand), which removes the pressure from the piece. The knurled part E is then given a quarter turn to the left which will bring the wide portion of the end D in line with the slot in the casting.

The bushing and screw can then be drawn back into the jig wall so that the part can be lifted out of the jig or fixture without interference. A locating pin G is driven into the wall of the tool and is used to locate the bushing in the proper position for operating.

A detail of the bushing is shown at Fig. 2 and its construction can readily be followed when used in connection with the description here given. Another feature should be mentioned, namely, the leaving of a slight clearance H between the wall of the tool and the bushing. This enables the bushing to be easily drawn back or forward when descending, the pressure of the screw always forcing the bushing against the rear wall. This device can be used for various sizes of screws.

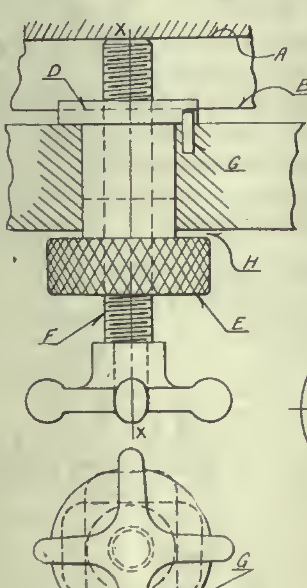
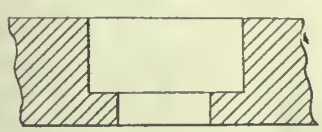


Fig. 1.



Section X-X.

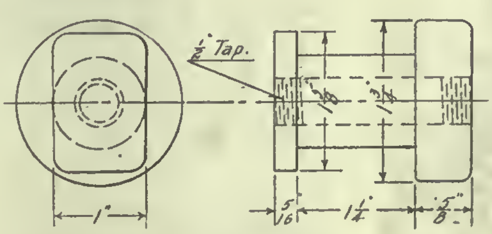


Fig. 2. Detail of Bushing

GENERAL VIEW OF THE FIXTURE.

WELDING BELL METAL

Bell metal is usually composed of about 80 per cent. copper and the balance tin, with the addition of small amounts of other metals to produce tone. The proportions of copper and tin produce a very hard and brittle metal, one which becomes increasingly harder to handle in very large bells. A bell weighing as much as 1,500 pounds, for instance, is cast very thick, not for strength but for foundry reasons. This type of bell will cool very slowly and should be handled carefully.

To weld, first V out the crack and drill a small hole at the theoretical extension of the crack. This will prevent further cracking. Place the bell on a fire-brick platform, supported above the platform by fire-bricks. Heat the bell carefully and slowly. When it is hot enough to melt lead, choke off the fire. Be sure that the supports under the bell are so arranged that no part of the bell sags. Proceed to weld in the usual way for brass or bronze, using a Tobin Brone rod. A special rod, of the same metal as the bell, would be better. The line of the weld should be slightly overcharged. Allow the bell to cool very slowly. When cool, clean up the line of the weld. After the bell has entirely cooled, it is said that the original tone may be entirely restored by again heating the bell as before, after which it is cooled suddenly with cold water. Large bells may be cooled by using two or three lines of hose.—"Welding Engineer."

Telling the Story of Safety by Moving Pictures

You Seldom Find Any Plant Inviting Their Employees to a Movie Show in Working Hours, But Here is One Case Where Not Only Do They Invite Them to the Show, But Actually Pay Them Real Money to Go and See It

By J. H. MOORE

THE prevention of unnecessary accidents is something in which the International Harvester Co. have always been interested. They have at the present time various safety councils, committees, etc., but in the writer's opinion their newest effort to educate their various workmen by means of the movies is worthy of special consideration.

They have prepared in two-part form a moving picture story of Old King Carelessness and his seven little imps. This scenario was written by David S. Beyer, chief engineer of the Liberty Mutual Insurance Company, and was adopted by the International Harvester Co. for use throughout their plants.

The picture is entitled "The Outlaw," and is presented in true movie form. Briefly, the manner of presentation is as follows:

Mr. Christie, who is chief safety engineer for this company, travels around through the various plants showing his safety story. On arriving at a plant, the general manager and himself map out a program of hours in which the various departments can view the film. For example, they accommodate from 100 to 150 persons at a time, and the picture takes a little over an hour to show.

Certain departments are grouped together and informed as to the time set aside for their viewing the picture. They are also acquainted with the fact that they will be paid at regular rates while attending the performance, and that it will therefore make no difference in their wages. Who wouldn't attend a movie show in place of working?

In this way the employees are doubly interested, for they cannot help but realize that if the firm is willing to pay them for sitting watching a picture, there must be something worth while looking at.

Of course, as can be understood, Mr. Christie is accompanied by a capable operator, with all necessary paraphernalia to show the film to advantage.

As employees enter the portion of plant set aside to present the picture, they are handed a neat little booklet, describing the picture they are about to see. This booklet has so much matter of real value in it that we reproduce various pages for reader's perusal.

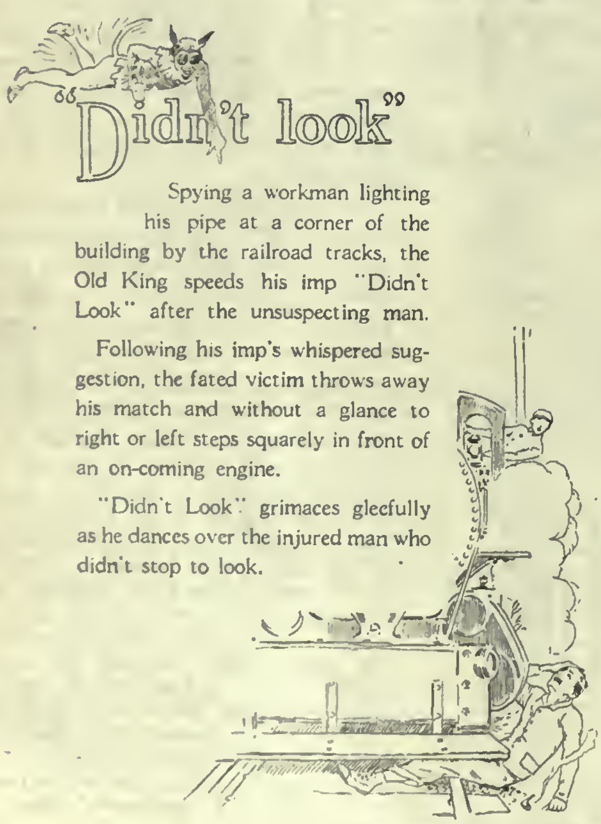
Now that we have described the method of interesting employees in the film, and the manner of its presentation, we will proceed with the story itself.

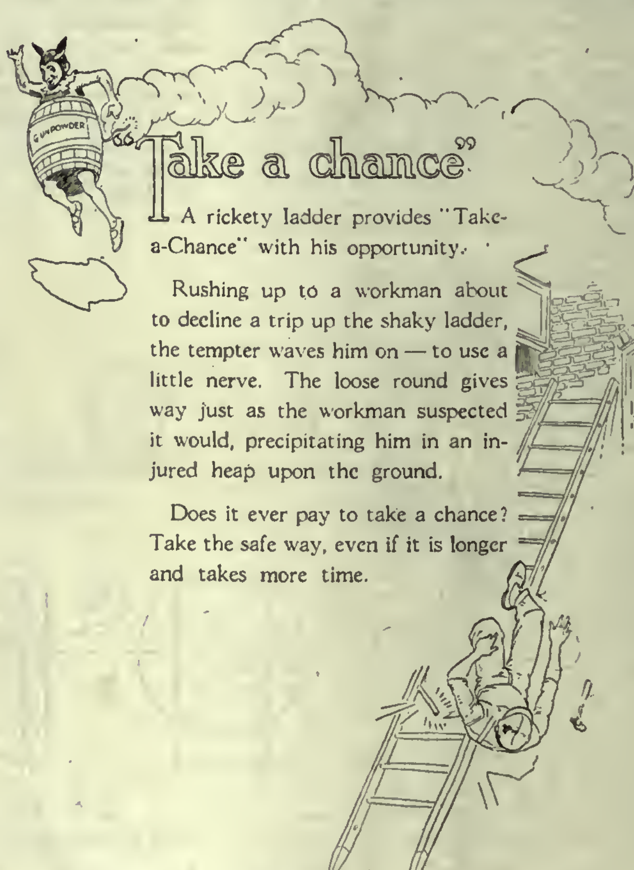
The Story of Old King Carelessness

The first thing which comes to view is a large-sized man, with a rather cruel looking face, who is called King Carelessness. He is seated on a throne, duly crowned, and holds as a sceptre a skeleton head. Having acquainted us who he is and what he stands for, he introduces his seven little imps, who are as follows:

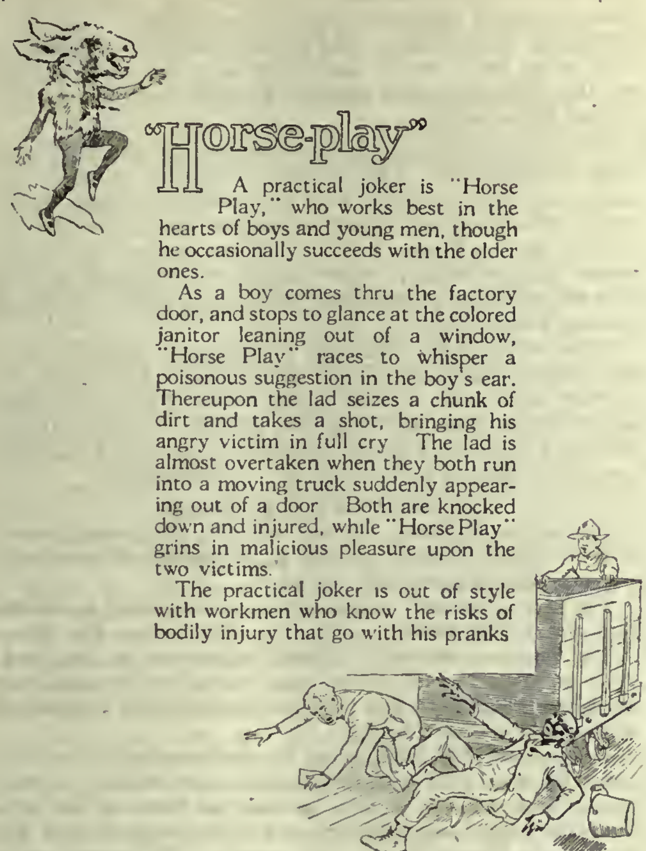
"Didn't Think," "What's the Use," "Horse Play," "Inattention," "Didn't Look," "I Should Worry," and "Take a Chance." As he states himself, these knaves are his slaves, and delight in corrupting the good intentions of all workmen.

The plot of the story now begins in earnest. We see the King leading his imps out to the front of a building,





THE TWO ILLUSTRATIONS TELL THE STORY FOR THEMSELVES



HERE IS HOW HORSEPLAY GOT TO WORK

which is labelled "Enny Mfg. Co." They decide that here is a good place to start their mischief, so stealthily creeping through the office of the plant, they get out into the factory itself, seeking unsuspecting workmen upon whom to practise their wiles.

"Didn't Look" Lands a Victim

The imp "Didn't Look" finds the first opportunity of creating damage. Spying a workman lighting his pipe at the corner of a building by the railroad tracks, Old King Carelessness speeds his imp in that direction.

Up runs the imp behind the man, whispering to him the suggestion that it isn't necessary to look where you are going.

Following the suggestion the unsuspecting victim throws away his match, and without a glance to right or left, steps squarely in front of an on-coming yard engine. He is crushed beneath its wheels, at which the imp runs back gleefully to his master to receive due praise for his efforts.

The complete scene is portrayed in such a natural manner that you cannot help but become convinced of the possibility of the same accident happening to even yourself in a careless moment.

"Take a Chance" Gets His Chance

The next scene depicted is that of a workman preparing to climb a ladder. On placing the ladder on the ground it is noticed that it is very shaky. The workman himself comments on this fact, and states that he doesn't like the look of it. The imp "Take a Chance" has been watching from a safe distance, and now gets his opportunity. Sliding up behind the workman he whispers, "Take a chance."

This the workman decides to do, and starts up the ladder. Half way up he meets in with a loose rung, and away it goes. So does the workman, who reaches the ground much quicker that he expected. He is, however, able to limp out of the picture, a sadder and a wiser man.

Once more we feel we should comment on the natural way these incidents are portrayed. Personally, the writer remembered one case where he himself took a chance which might have resulted in similar disaster.

The Danger of Horse Play

The third imp to start trouble is Horse Play. It is safe to say that Horse Play starts trouble in many a plant, but in this case the whole affair started with a boy coming through the factory door. Noticing the colored janitor leaning out of a window, Horse Play whispers the suggestion to the lad to have some fun at the janitor's expense.

Acting on the suggestion, the lad picks up a chunk of dirt and takes a shot at the janitor, bringing him after him full pelt. They both run, when suddenly a moving truck appears out of a door and runs them both down, injuring them to quite an extent.

Horse Play, having accomplished his object, prances off, while both workmen have, at serious cost, learned their lesson.

Inattention Scores a Point

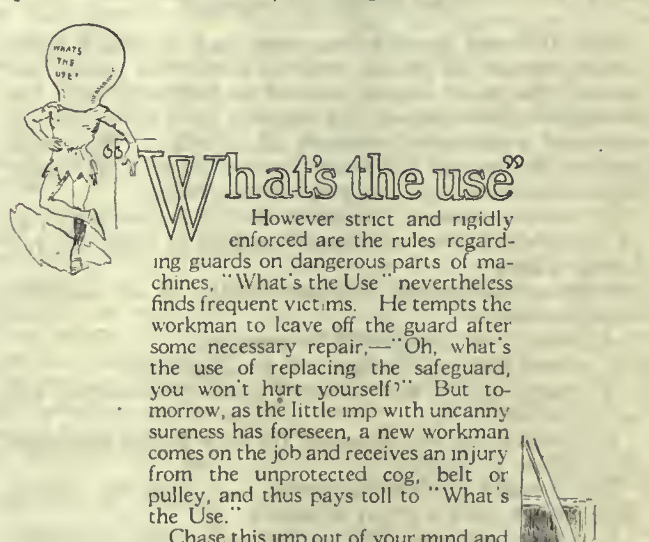
Inattention next gets his opportunity. Two men are carrying planks, tandem fashion, across the factory floor, when a pretty girl appears on the scene. "You don't need to pay attention to where you walk," says Inattention, and the men act on his suggestion, placing all their attention on the young lady. A pile of wood gets in their path, and down they go. The complete story is told so simply that it demands attention.

Oh, What's the Use!

We next meet with an old friend in the shape of the imp "What's the Use." We often use this expression; so now let us see how he works.

The scene depicts a workman about to start down a flight of stairs. At the head of these stairs is a warning to keep your hand on the rail as you go down. The workman reads this notice, but is tempted by our familiar imp, who whispers, "What's the use." The workman decides that the imp is right, and the notice wrong, so sticking his hands in his pockets, off he starts down the steps.

Partially down, he hits a loose step, and away he goes pell mell to the bottom, arriving at the floor in a dazed



WE ALL KNOW HOW EASY IT IS TO SAY "WHAT'S THE USE and injured condition. Of all the imps this "What's the Use" is certainly well known.

"I Didn't Think" Causes Trouble

Who hasn't said regretfully, "I didn't think," after some accident? In the case presented in the picture we see the elevator attendant reading baseball news and more interested in this than in his elevator. A workman on a lower floor starts his loaded truck on its way without a thought. He forgets to ring the warning bell, when suddenly the elevator starts when his truck is only partially on. Up

THREE VALUABLE AIDS TO SAFETY

goes the elevator, and down goes the workman to the bottom of the elevator shaft, with disastrous results.

Now Enters "I Should Worry"

Last, but not least, comes the work of that imp called "I Should Worry." We see two workmen piling castings outside in the factory yard. Suddenly one of the men gets his hand caught and bruised. His co-worker suggests that he go and see the doctor, but he pooh-poohs the idea, spits on the wounds, remarks that it's merely a bruise and that he should worry.

Blood poisoning, however, sets in, with the result that his arm has to be amputated. "I Should Worry," who has been always hovering near, grins his triumph on seeing the result of his work. At this point Part I comes to a close, while up comes the reassuring remark that "Safety First" comes into his own.

Enter the Safety Engineer

Part II opens up with the office staff of this concern busily engaged at work, when in comes the safety engineer. He is, of course, granted an interview with the manager, who expresses his surprise at the long list of accidents which have happened at his plant. He states that to the best of his belief he had thought Old King Carelessness had been kept out of the factory.

He cannot, however, dispute the evidence shown him, so on the advice of the engineer he decides to adopt the following plans: -

Practical safeguards will be installed on all machines where needed.

All dangerous places will be guarded.

A works safety inspector will be appointed.

A central safety and workmen's safety committee will be organized.

Each workman will be asked for help in this campaign to eliminate accidents.

The foremen will be taught to take pride in running their departments without accidents.

Last, but not least, the safety committees will boost the cause of safety in every way, telling the workmen how accidents happen in other places, using the moving picture machine as a medium.

The plans are heartily endorsed, and a safety meeting started at once. The manager sends for his superintendent and other departmental heads, explaining to them the idea. The safety engineer clears a space on the wall and sets up his portable picture machine.

As soon as everyone is seated, the engineer starts the pictures with a scene of crippled men, some with arms off, others with legs and hands gone, or maimed by infection, eyes out, men on stretchers, on crutches, and others defective because of different industrial accidents.

He tells his audience that even should this procession keep going on, it would take eight days and eight nights for the crippled to pass who are maimed each year in the United States alone.

He next introduces some of his assistants who can fight King Carelessness. The warning gong that is used for trains, elevators, transfer cars and trucks, is shown. Then comes the signal bell, which is ideal for use at dangerous corners and buildings, and at railroad tracks, etc. Now comes safety railing, who delights in protecting unguarded corners, excavations, belts, cogs, gear, and other moving machinery.

We next see Safety Bulletin, who requests that you read his message carefully, as he tells of ways and means to prevent accidents. Lastly, along comes First Aid, who urges you to come to him at the slightest injury. These different characters are so ingeniously displayed that we reproduce them in this article for readers' benefit.

The Downfall of Carelessness

Having shown these various helps in overcoming carelessness, each foreman decides to co-operate in eliminating accidents throughout the plant.

The scene changes, going back over the same incidents that previously caused accidents. Up comes the same fellow who was seriously injured by the yard engine, and by a combination of safety sign, gong, and railing, the workman plays safe and does not listen to the temptings of the imp "I Didn't Look."

Next comes the incident of the stairway and the railing. By means of a safety bulletin the worker is convinced that it would be wise to keep his hand on the railing. On going down he strikes a loose tread, but as his hand is on the rail no harm results. He immediately obeys the instructions on the safety bulletin, which says that all dangerous spots should be reported to the safety committee. At once the loose tread is repaired, removing the danger.

We now see once more the two men unloading castings, the one chap getting his hand pinched as before. Being instructed in the need of care to any injury, no matter how slight, he goes to the doctor, receives first aid, and thus avoids infection. The imp "I Should Worry" tries to persuade the workman against this step, but without avail.

AFTER THE SAFETY ENGINE HAD GOT TO WORK

Having demonstrated the value of safety in these ways, the engineer remarks that safeguards, safety bulletins, clean passage ways, inspection, organization, can do a lot, but can only save about one-half of the accidents occurring in industry. Carelessness causes the other half. "If we expect to save workmen from injury we must drive out King Carelessness from every factory," says the engineer, when suddenly King Carelessness is found to be in the room, actually listening to the safety talk.

Continued on page 275

The Present Status of the Electric Furnace

The Electric Furnace Has Found Its Own Particular Sphere of Usefulness and With Increasing Knowledge of Its Capabilities It Will Become a Necessary Aid in the Iron and Steel Industry

By W. F. SUTHERLAND

THE electric furnace as a metallurgical instrument has come to stay. Its importance during the war was very evident, and the ease with which it handled troublesome raw materials such as shell turnings, together with the high quality and comparative cheapness of the resulting product, brought it very prominently to the fore. Extravagant claims have been put forward as to a possible revolution in the steel industry through its aid and, equally pessimistic views have been held as to the future of electro-metallurgy—the truth will probably be found midway between the two extremes and the future work of the electric furnace in the iron and steel industry will be the making of steel for the steel foundry, high grade and complex alloy steels and the refining of hot metal from the open-hearth and Bessemer. There are also excellent possibilities for its use in the making of steel direct from ores; this feature is dealt with at greater length below.

The crucible process, while one of the earlier methods of producing steel, has been almost superseded by the electric furnace. Several factors are responsible for this. The crucible process is expensive and at best can never handle large quantities unless an enormous plant is installed. It is also subject to metallurgical limitations which are absent in the electric process. In the latter the carbon content can be more accurately controlled and refining is possible to a far greater extent. The costliness of the former process is also obviated.

When the open-hearth or Bessemer is considered the advantages are not so apparent, at least in the quantity production of steel. For plants working from cold metal the electric furnace is ideal and is rapidly supplanting the Tropenas convertor and the smaller sizes of the open-hearth. Better steel results; the ease with which occluded gases are eliminated, the refining operations which can be carried on and the facility with which alloying additions can be made, all serve to give the electric furnace a very decided advantage. While good steel does not necessarily result from the electric furnace, since it in itself is only a means to an end and depends like everything else upon intelligent operation for best results, it is possible to produce a much superior steel than that obtained by the other processes mentioned. It must be remembered in this connection that the better the product the more it usually costs and the production of high-grade steel in the electric furnace necessarily costs more than a poorer quality. Cheaper grades of scrap, cheaper because of their physical condition, can be successfully handled, thus the familiar shell turning of bygone munition days made an admirable raw material.

While the electric furnace process will likely supplant other forms of steel making from cold scrap, it is unlikely that it will ever entirely supplant the Bessemer and open-hearth in the making of steel direct from the product, either hot metal or in pig form, of the blast furnace. Rather, it will become an adjunct to these types of furnaces, being used for finishing off the product resulting from their operation. The reason for this is apparent when the reduction of the carbon content of the blast furnace iron is considered. It is entirely possible to bring the carbon down, but the reactions resulting from the addition of ore for this purpose are not conducive to furnace life and the time taken greatly increases the power input required. Finishing off in the electric furnace is entirely practicable and is being practised to-day with material benefit to the physical properties of the resulting steel.

The Electric Smelting of Iron Ores

Much effort has been expended on the problem of making iron and steel direct from iron ores. In its essentials, simplicity itself, many difficulties have been encountered and the cheapening of the process to a point where it would be able to compete with the blast furnace has been a matter of extreme difficulty.

Many countries possess large deposits of iron ore together with abundant water powers, but little or no coal. For these countries electric smelting is ideal, and in one of them, Sweden, has been practised for some time successfully. The success achieved by present methods is only comparative however, and the industry depends entirely on peculiar local conditions for its continuance.

The electric smelting of iron ores differs from blast furnace practice in that only sufficient carbonaceous material is incorporated in the charge to reduce the ore and to give it the necessary carbon content. None is needed for the supplying of heat necessary for reduction, this being furnished by electric energy. A material saving in fuel is thus effected, and where this is imported at considerable expense the process is economically feasible.

The blast furnace suggested one line of attack and the furnaces used in Sweden at present are the outcome. These consist of a shaft and bush similar to those familiar in blast furnace practice, superimposed upon a hearth fitted with electrodes. The reduction is effected by carbon and a portion of the waste gases are recirculated. The electrodes are submerged in the charge and serve to furnish the heat for reduction to fluid metal. While the saving in fuel is important the consumption of power is considerable, ammounting to about 2,000 kw. hr. per metric ton.

The process also suffers from the further disadvantage of producing only pig iron. The iron produced under the best operating conditions is a white charcoal iron, and while of high grade, can only be used in the open-hearth as melting stock.

The direct production of steel from iron ore has been attempted by Stassano and others in the arc furnace, typified by the familiar types of the steel foundry, although differing from them greatly in design and construction. Here also a measure of success has been attained but at considerable expense, thus rendering the process economically impossible.

The true solution of the problem will be found in a discontinuous process—one in which the bath is subjected to the refining action of slag or other influences for the proper time. Furthermore the reduction of ore to the metallic state should be accomplished without the aid of electrically-produced heat. In addition to this the carbon content of the material changed into the electric furnace should be such as to eliminate a lengthy period for its adjustment.

The solution of the many difficulties surrounding the conversion of iron ore into steel without the aid of the blast furnaces and by the use of electric heat has been brought appreciably nearer solution by a method devised by J. W. Moffat of Toronto. An article descriptive of the process and outlining the patent claims appeared in CANADIAN MACHINERY last year, and a brief outline will be presented here.

The ore is first treated in a reducing furnace of comparatively low temperature in which it is deprived of its oxygen as completely as possible and is then in a physical form known as "sponge." This product is transferred, either hot or cold, into an electric furnace to be melted down and finished into metal. The finishing of the metal in the melting furnace makes the process a discontinuous one—more convenient in operation and more suitable for meeting trade demands.

The various phases through which the ore passes in its conversion into metallic sponge are of some interest. Hematite (Fe_2O_3) begins to be reduced at a temperature of about 300° C., and has been converted wholly into magnetite (Fe_3O_4) at a temperature of 450° C. This ore, with the natural magnetite in the charge, begins to be reduced to a ferrous oxide (FeO) at a temperature of about 500° C., and the reaction is complete at about 590° C. Ferrous oxide begins to be con-

Continued on page 65

WELDING AND CUTTING

Electric Arc Welding Equipment

(Continued from Feb. 26th issue.)

By H. L. UNLAND

For small work, the positive lead may be bolted to an iron plate forming the top of a work bench. The work may be set on this bench, the contact being sufficient to carry the current. A vise mounted on the table will often be found desirable. If the work is too large for the table it may be set beside the table and a bar laid across to it. This will provide sufficient current-carrying capacity, provided scale and rust do not prevent contact entirely. The rails in a round-house if bonded are usually connected to the positive lead, and any car on these tracks may be welded by running only the cable leading to the electrode, the return cable being unnecessary since the current will be carried back through the rails.

A convenient terminal for the positive cable consists of a copper hook of proper size to which the cable is bolted. The terminal may be laid on the work or hooked on a projecting part. It is seldom necessary actually to clamp the return lead to the work unless the metal is covered thickly with scale or dirt, which acts as insulation. Even here it is easier to chip or brush off a clean place for the contact than to use a clamp.

If welding is to be done in a room where other employees are doing other work, screens should be provided around the welding operator. They should be high enough to prevent the light striking much of the ceiling since the flicker of this light would probably affect the other workmen. The effect, while probably not injurious, would be irritating. White walls and ceiling should be avoided in a welding room.

Gas burners for pre-heating, and fire-brick, sand, or sheet asbestos for covering, are useful, especially for cast iron work, which in many cases should be preheated uniformly to a red heat and welded while at this temperature. A receptacle for water is desirable, in which the electrode holder can be cooled when continued use makes it too hot.

Differences of Opinion

Some operators feel that gloves are necessary to protect the hands from the arc. Other operators, however, find gloves to be in the way, especially when working with the metallic electrode. If desired, however, any leather or cloth glove will give sufficient protection to the skin of the hands, which is much less sensitive that the skin on other parts of the body. The arms, neck and face should, however, be covered, since exposure of these parts will probably cause burns similar to sunburn. These burns, while painful, are not serious.

It is the experience of a great majority of welders that flux of any kind is unnecessary, and further, that it is a source of danger because it is likely to contaminate the weld. If the work is kept clean by brushing at frequent intervals and ordinary care is taken in the operation of the arc a good weld can be made without flux. If these precautions are neglected, flux will not make a good weld.

Cleanliness is a requisite for making a good, strong weld. Scale, rust, grease, soot, and foreign matter will contaminate the weld, and such inclusions necessarily weaken it or else make it hard. Impurities may also make the metal porous and spongy because of liberation of gas. Pieces of foreign matter may prevent the molten metal filling all parts of the weld and may cause cavities. Various methods for cleaning are in use, among them being pickling for small parts, washing with gasoline or lye, boiling with lye, sand blasting, chiseling, and scratch brushing, the method depending on the local conditions.

Preparatory to welding locomotive tubes to the sheets, it is sometimes advantageous to send the locomotive out on a run in order to burn off the grease and then to clean off the oxide and soot by sand blasting. Another method is to heat the boiler to normal by steam pressure and then clean by sand blasting or scratch brushing.

In welding heavy sections where it is necessary to deposit several layers of metal, the surface of the preceding layer should always be cleaned before starting the next.

When sections ⅛ in. or less thick are to be joined, the edges need not be beveled but they should be separated a small amount. Thicker sections, besides being separated by ⅛ in. should have the edges beveled to give a total angle of 60°. In some special cases angles as low as 30° or as high as 90° may be necessary, but an average safe value is 60°. Still heavier sections may be beveled from both sides and the weld made from both sides. In the latter case a layer should be put on one side and then a layer on the other to prevent warping. For long seams the edges should be ⅛ in. apart at the end where the weld is started, and at the far end the space should be ⅛ in. plus 1½ per cent. of the length. This takes care of the expansion of the metal in the sheet and also of the contraction of the metal in the weld as it cools. Another method of reducing expansion is to put in short sections at intervals, welding one layer at a time, starting at the centre and working alternately toward either end. Then put one layer in the open sections, and continue in the same way till the weld is completed. The welded section of any layer should not match those in the layer below or above, the joints being broken as in laying brick work.

The welding of complicated shapes such as fly-wheels and some castings may require pre-heating at certain points to produce initial expansion, which will be overcome as the weld cools. In some cases the entire piece must be pre-heated and, in some cases, after welding the whole piece must be annealed. This is sometimes done by heating the piece uniformly, then covering it with sand-asbestos and allowing it to cool slowly.

Preparation

In welding cracks in plates, forgings, or castings, the crack should be chiseled out to get a good bevel. This chiseling should extend entirely through the plate with ⅛ to 3-16 in. clear opening on the back or to the bottom of the crack in castings or forgings. Sometimes in boiler work ½ in. holes are drilled well beyond the ends of the crack and the crack chiseled, beveled, and welded.

In welding with the metallic electrode the arc should be kept short, not over ⅛ in. long. The current should not be greater than that recommended for the given electrode diameter. Excessive current causes burnt or porous metal to be deposited. The arc should be kept constant in length to ensure uniformity in the metal deposited. In welding a seam the electrode should be moved in a zigzag or circular path advancing along the seam. The metal will adhere only to the surface on the work actually played on by the arc, so care must be used to bring the arc in contact with the whole surface to be welded.

The electrode must be connected to the negative terminal. If the polarity is reversed the arc will be more difficult to maintain and the deposited metal will not be as good as it should be. In starting the arc, the electrode should be just touched to the work and withdrawn immediately to the required distance. If the electrode is held too long in contact it will weld to the work causing some delay in freeing it and starting again.

The operation of welding overhead is the same as in normal welding. The difficulty lies largely in holding the electrode steady in the cramped position usually required. If the arc length is kept constantly short the metal will be successfully deposited. The appearance of an overhead weld is sometimes marred by projecting drops of metal or by uneven thickness of the deposited metal, but this can be overcome by proper manipulation of the electrode. A rest for the arm will sometimes assist the operator to hold the electrode steady.

When using the carbon electrode the holder should grip the electrode from 4 to 5 inches from the end. For ordinary work the electrode should be tapered to a blunt point at the working end to keep the arc from wandering over the end of the electrode. As the electrode burns away with use, the holder is moved back along the electrode to keep the length of working carbon constant. The burning away of the electrode will tend to keep the taper approximately constant.

The arc is struck in the same manner as with the metallic electrode, but a longer arc should be used. From 1 to 1½ inches is the average. The arc should not be too short when welding or depositing metal as there is danger of depositing carbon and probably causing a hard weld. In cutting or in melting off metal the arc should be kept short, about ½ in. being an average length.

To cut metal (for which purpose the carbon electrode must be used) the arc is operated like a gas torch. It is held in one place long enough to fuse the metal and allow it to run off. For thin plates laid flat, a hole is melted by holding the arc on one spot, then the electrode is slowly advanced along the desired line, the molten metal dropping out below. For thick pieces, such as shafts and castings, it is desirable to start at the top on one edge and work down, allowing the molten metal to run down through the cut. It is often necessary to follow the molten metal with the arc to keep it melted until it runs off.

The width of the cut will depend on the size of the electrode used and on the skill of the operator in keeping to a straight line. The cut must be slightly wider than the diameter of the electrode in order to allow the arc to be played on the bottom of the cut. The cut will be wider for thick sections than for thin ones. The edges of the cut will not be smooth because some of the molten metal will not run away and also because the arc will tend to jump from one point to another and cause an uneven cut.

To deposit metal with the carbon electrode, the arc is struck as above, but is not held in one place long enough to melt through. A pool of molten metal is established and a melting rod of metal is fed into the arc and melted on the work. It should all be heated thoroughly to ensure a complete union before more metal is added.

Since heavier current can be used with the carbon electrode than with the metallic, faster work can be done in depositing metal. The quality of the weld is not quite so good as when the metallic electrode is used. However, for filling holes in castings, building up worn spots, etc., the carbon weld is satisfactory and should be used. Because of the high temperature and large amounts of heat liberated when using the carbon electrode, the electrode holder is likely to become hot, and under some conditions to melt at the end. When the holder begins to get hot it should be plunged in a receptacle of water kept conveniently near the operator.

Cast iron, because of its properties, is unsatisfactory for welding by any method. Its low strength and brittleness causes it to break from expansion and contraction strains unless precautions are taken, and even then a successful weld cannot be ensured. Pieces of simple cross-section and heavy pieces present much less difficulty than complicated shapes, but because of the undependable nature of cast iron, care is required in all cases. The experience and skill of the operator are large factors in determining whether or not a given weld will be successful.

SAFETY BY MOVING PICTURES

Continued from page 272

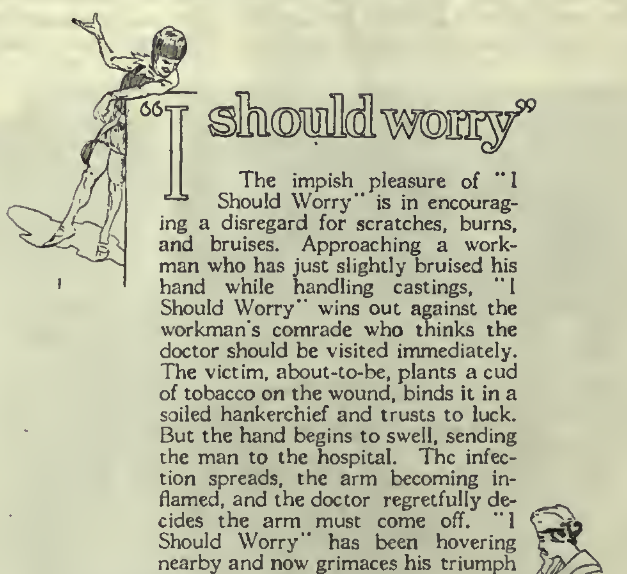
With one accord the men jump up and throw him out of the factory. They next run out into the factory, and, after a long skirmish, succeed in catching his seven imps of trouble. They drag them through the office, then throw them out beside the King, who is now dethroned.

After ejecting them, the manager of the company congratulates his men upon their splendid enthusiasm. He promises that if they do their part to keep the safety thought alive, he will endeavor to do his part by installing proper safeguards, etc.

With all working together in harmony, we leave the concern free from carelessness and determined to reduce the number of accidents to the lowest possible minimum.

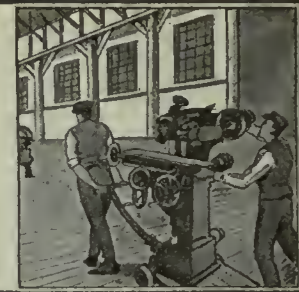
Having thus told our little tale of safety as portrayed by the pictures, we cannot refrain from adding our own personal comment on this novel method of presenting the cause of safety.

To our mind the scheme is deserving of the heartiest of co-operation. We cannot too strongly boost the cause of safety, for its need is more apparent every day. Carelessness is a monarch whom we should not only sit on, but squeeze the life out of, so, in order that readers can get a good idea of certain scenes in the picture described, we illustrate throughout the article some of the most striking scenes.



The Imp "I Should Worry" causes many a trouble such as shown.

DEVELOPMENTS IN SHOP EQUIPMENT



GARVIN FORM MILLER

The distinguishing feature of this machine over that of previous designs is the change from vertical spindle to that of horizontal type, bringing with it certain other desirable modifications as hereafter described.

It is designed for cutting either flat or cylindrical cams. Illustration, Fig. 1, shows it arranged for flat cam work. In this set-up, it will be noted that the work is mounted on the end of the work arbor, toward the spindle, with the former at the outer end of the arbor. Worm and worm gear drive the work arbor from the universal power feed shaft, to be seen at the front of the machine. Power is transmitted through spur gearing, giving three changes of feed for the flat cam cutting fixture only.

The arm containing the work arbor pivots on the forward end, and is guided at the rear end by guides, all mounted on the same table. The arm has, in addition to its own weight, that of detachable weights to keep the former pin against the former, offsetting the stress of the cutter. These weights can be added to either end of the arm, and are made so as to release the pressure on former when cutting steep angle cams.

Illustration No. 2 shows the machine arranged for cutting cylindrical cams. In changing the flat cam fixture to the cylindrical fixture, the entire slide shown bolted to the saddle of the machine can be taken off and laid aside. The power feed universal joint shaft readily detaches for this purpose, and attaches to the cylindrical fixture.

In operation, the feed rotates the work on the work arbor, the work being mounted on the far side of the fixture and the former on the other end of the work arbor. The former pin, shown in the front of the machine, is kept against the former by weights.

The movement of the cylindrical fixture is very sensitive, as it works on large balls in a V-shaped, tool stool track. The feed of both attachments can be disconnected by clutch, giving hand feed control by wrench. This will be found very handy in setting up for cams that are cored, also for helping over steep angles. The feed of both attachments can be disconnected by clutch feed control by crank wrench.

The worm shaft is provided with a square end to receive the crank. The spindle of the machine is of Garvin standard milling machine construction. All gearing is housed, protecting it from damage or injury to the operator. There are two changes of feed provided on the machine when using the fixture for cutting cylindrical cams. Following are its principal dimensions:

Capacity, any type of cam	1" to 12"
Taper hole in spindle	No. 10 B. & S.
Size of cutter used	3/16 to 2"
Number of feed changes by four-step friction cone pallet	9
Cylinder cam throw	9½"
Flat cam throw	6"
Number of feed changes on flat fixture only	3
Number of feed changes on cylindrical fixture	2
Swing of cylindrical fixture	12⅞"
Speed of friction pulleys on countershaft	120-160
Floor space	44" x 54"
Domestic shipment, crated weight (with both fixtures)	2700 lbs.
Foreign shipment, tight boxed (with both fixtures)	3000 lbs.

FIG. 1. THE MACHINE ARRANGED FOR FLAT CAMS

FIG. 2. THE MACHINE EQUIPPED FOR CYLINDRICAL CAMS

FIG. 2. PLATE AND ANGLE HEATING FURNACES

ROCKWELL FURNACES

The W. S. Rockwell Co., New York, have placed on the market some shipyard angle and plate heating furnaces, which are herein described. Both furnaces illustrated are typical furnace equipment of any shipyard engaged in building merchant ships.

The angle heating furnace illustrated at Fig. 1 is of double-end construction, permitting the charging and heating of material from both ends. This type of furnace is built in any chamber width, height or length required, and with door opening on one or both ends.

The plate heating furnace is illustrated at Fig. 2. The doors on this furnace are quite large and heavy, and, to facilitate opening and closing, are mechanically operated. Chamber width, height and length may be made to suit the character of the work and production requirements, and the furnace may be built either single or double end.

These angle and plate heating furnaces are generally built for the use of oil or gas fuel, although coal-fired furnaces may be used when local conditions are such that coal must be used. When oil fuel is used, 25 pounds pressure per square inch will do. At any rate, not more than 50 pounds is necessary. The pressure should be perfectly uniform, whatever the amount.

The air pressure may be from 12 to 16 ounces. Higher pressure increases the power cost and is not necessary. While somewhat lower pressure may be used, the atomizing effect on the oil is then not quite so satisfactory.

The same air pressures may be used for gas fuel.

Burners can be furnished that either fuel can be used, or simultaneously if desired.

Belleville.—The ice on the river here is of such an unusual thickness that grave fears are entertained that there will be a flood when the river opens up. In order to try and prevent this, a channel will be cut in the ice just north of the river mouth. The ice will be sawed and ploughed for a distance of about 1,000 feet, so that when pressure from upstream occurs, the ice will break away. The work will take about a week. The flood which occurred two years ago caused damage amounting to nearly $100,000 on both sides of the river.

FIG. 1. DOUBLE-END ANGLE HEATING FURNACE

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PRINCIPAL CONTENTS

Where Are Prices Going?

WHERE are prices of steel and iron going to land? You have heard this question asked a good many times in the last few months. It is easy enough to sit back, and on your fingers reckon it out that the peak has been surpassed, and that prices are now operating on an ultra-peak, or something like that. It is not difficult to say that the purchasing power of the last buyer is the final test of the market, and your own purse will wander along and bear eloquent testimony to the fact that the buying power of the individual is worm-holed and shaky.

And after you have done all these things, come on around and walk with the man who prepares the market reports on iron, steel and machinery.

We drop into a machine tool warehouse. The conversation turns to exchange, prospects, supply and delivery. Talking on exchange gives people a good opportunity to get tied up in mental cramps and arrive at no place at all. It is not long before this happens. The dealer thumbs over a lot of letters he has put to one side for you. He tosses a couple over—"Ten per cent. increase on boring mills." Said boring mill may be worth from eight to twelve thousand dollars, and the increase is from eight to twelve hundred. So much for that.

Next for the steel trade. Here's a jobber who handles a lot of material. He tells you that the base price on bars goes up to 5.50 a pound. Not long ago they moved to 5c per pound, and he was sure they would stay there. He's not sure they will stay at 5.50.

The next firm has material coming in. They got a chance to get some sheets at a premium. They took the chance, paid the price and exchange, and announce that their resale price will be at least 9 cents. Just then we happened to think that a few days ago we were looking back at figures in 1913 and found that quotations at the end of that year were 2.70 per pound. Plates are also marked at 7.25, against the 1913 price of 2.20.

Just here it is interesting to note the way these prices held for a number of years, and then to see their present strength. The above prices have been, it must be remembered, warehouse figures.

Take Pittsburgh, for instance. The term "composite steel" has been brought into use to show the bulk movement of prices of finished steel products, excluding rails. For instance, in composite steel are included bars, plates, shapes, pipe, wire nails, sheets and tin plates. For January, 1915, the price of composite finished steel was 1.4500 per pound.

Pittsburgh quoted sheets as follows:—

Year	High	Low
1896	2.45	2.15
1897	2.15	1.95
1898	2.55	1.80
1899	3.35	2.00
1890	3.25	2.90
1901	3.85	3.00
1902	3.10	2.75
1903	2.70	2.35
1904	2.30	2.00
1905	2.40	2.15
1910	2.40	2.15
1911	2.20	1.75
1912	2.25	1.80
1913	2.35	1.80
1914	1.95	1.80
To-day	6.00	5.00

Before stopping, go to the scrap markets. Dealers are marking up the prices they are willing to pay for material. That means they are going to ask more from the melters, the steel mills and foundries. For instance, they raise the price for No. 1 machinery scrap iron to $33 per ton. The chances are that were a nice tonnage of this to be offered, something better would be offered. Dealers, were they selling, would ask $40 or more at the consumer's yard. And yet at the beginning of 1914 the price the dealers would pay only $12 per ton, not one-third of the present figure. Heavy melting steel is quoted now at $18, against $8.50 in 1914.

Dealers are quoting tin this week at 76c per pound, a price well down from the level it reached during the war. For instance, local dealers in the month of July, 1918, named $1.25 per pound at the market value. In 1914, at the start of the year, the price was from 39c to 40c.

Many managers who follow markets and tendencies very closely, claim that we are in the peak zone. This claim is not new. We have heard it for weeks, and for months that are getting stretched out into years. It is hard to see where lowered prices are going to come from in the immediate future. Of course, the bolt from the blue could accomplish it, but the bolt does not generally fall on an empty market.

Appreciated the Letters

A LARGE manufacturing concern sent frequent and urgent demands to a certain delinquent dealer, and, being unable to get so much as a response, sent a representative to wait upon him personally.

"Why haven't you paid your account, or at least written us concerning the matter?" the representative asked.

"My dear sir," responded the delinquent smilingly, "those collection letters from your firm are the best I have ever seen. I have had copies made and am sending them out to the trade, and it's wonderful the number of old accounts I have been able to collect. I haven't paid my bill, as I felt sure there was another letter in the series. I have some hard customers to deal with and I need that last letter."—*Coal Trade Journal.*

AS FAR as Canadian buyers are concerned, the exchange situation continues to "sore."

Factory or Farm?

HERE is something that ought to make people sit down and think seriously.

A Toronto man was coming down on the train from Bruce county a few days ago. At one of the small stations in the farming community there got on three men, father and two sons, apparently of German extraction, and they had tickets for a well-known Ontario furniture and industrial centre. The course of their conversation was quite easy to hear, and put together, it mounted to this:

"We are going to work in the factories. We can make from six to seven dollars a day there and work only eight or nine hours a day. That is far more money than we have ever made on the farm, and in far less time. At home we have to work long hours and we do not get such a quick and sure return. So we have left only one boy with his mother on the farm, and we are going to work in the factory. When things get bad there we will go back to the farm."

Now, what are you going to do with your "back to the land" cry in the face of that? Back to the land is only a slogan, and a catch-phrase. Leaving the land and flocking to the cities is a reality and a mighty serious one.

It's all very well to explode about such things, and to say that the place for these people is on the land. Forget it. What would you do yourself? If you are the average man, you would do just exactly what those German farmers are doing. You would put your best effort in on the shop payroll and your farm would become sort of a safety-first place where you could go if the worst came to the worst.

It is well that the people should know exactly the trend of events and of people. It requires very little reasoning to see that, by the conditions that industry is creating in the large industrial centres, they are jockeying the whole system of production into such a corner that some day we will wake up to find that we are a very hungry people.

THE papers had a story a few days ago about a hired man and a cow that were lost in 20 feet of snow near Montreal. There's many a man in Ontario who has brought in a shipment of Montreal stuff, and he has seen drifts that would make a 20-foot affair look like a mere sprinkling.

DO YOU notice how cheap the family can live in this country since the prices of things have all been controlled!

Do Fashions Change in Engineering?

LUBRICATION experts have told us for a long time that acid of any kind in lubricating oils was dangerous and should never be tolerated. Corrosion troubles, under certain conditions, and other disadvantages were supposed to result from any lubricant not almost chemically free from either mineral or fatty acids.

Along came two investigators who, in a paper before the Society of Chemical Industry, claim that this is all wrong, and that by adding a small proportion of fatty acids the lubricating qualities of the oil are vastly improved.

The authors use the expression "germ process" to describe the oil made by using one or more fatty or other acids with one or more mineral oils, because the world has been taught for generations to look upon acid as the deadliest enemy to good and safe lubrication. Had they not used guile of some kind to cover the leopard's spots, "peaceful penetration" had been almost impossible.

The word germ has been used in this sense since, while the fatty acid germ is not alive in the sense that germs are, it is very active and so, it is claimed, affects the properties of the oil in a profound manner. Compounded oils have, of course, long been known, and many specifications call for so much mineral oil and so much of some particular vegetable or animal oil. Formerly all specifications and other requirements strictly limited the amount of free acid in compounded oils to a very small amount, and in mineral oils to none at all.

These investigators have upset all this, and instead of vegetable or animal oils and fats, they add fatty acids to mineral oil and eliminate the organic oil. The fatty acid produces an oil with varying properties as desired and it is quite possible to produce an oil which will work well in the crank-case of forced lubrication engines without emulsification.

For a good, heavy marine engine oil it has always been considered necessary, and is so to-day, to use from 10 to 25 per cent. of a thickened or blown oil—as a rule, thickened rape oil. This gives great viscosity, also very good "lathering" properties to the oil. A marine engineer must see the oil "lather" well, or it is no use.

The standard specification for marine bearing oil for one of the semi-Government departments in Great Britain is a compound of about 20 per cent. "of fatty oil"; but the total fatty acid content must not exceed 1 per cent. This department was considered most conservative, yet germ-process-marine-engine oil is doing, and has done for about eighteen months, the same work for which a 20 per cent. compound oil was previously considered essential.

In the power plant and on board ship it is quite possible that this new lubricant may effect considerable changes.

A TEAM of donkeys sold in the States a few days ago at $700, so don't be offended if some person calls you a jackass.

Ask Yourself—

Am I hitched up right, or am I a round peg in a square hole?

Do I feel every drop of blood and every fibre in me tugging away at my ambition, saying "Amen" to my work?

Am I backing up my chance in life in every possible way, or am I sliding along the lines of least resistance?

Am I keeping myself fit to do the biggest thing possible to me every day of my life?

Am I working along the line of my talent, or am I getting my living by my weakness instead of my strength?

Am I strengthening my weak points, making my strong points stronger, and eliminating the things which are keeping me back, the enemies of my success?

Do I decide things quickly, finally, or am I forever on the fence, fearing to make definite decisions which I cannot reconsider?

Have I the initiative which begins things without being told to; which does things without waiting for others' instructions?

Do I dare to attempt the thing I instinctively feel capable of doing, and I know that I ought to do?

Have I the courage which dares to branch out in an original way, dares to make mistakes that may humiliate me if I should not happen to succeed?

Do I try to develop that bigger man back of the smaller man I am, by obeying the God-urge that ever bids me up and on to greater endeavor?

If you can answer the above questions in the right way, you will bring out a hundred per cent. of your ability instead of the fifty per cent. that the majority of young men are content to develop; you will attain your ambition and be what you long to be.—*Success.*

MARKET DEVELOPMENTS

Getting the Goods is the Real Problem to Face Now

Prices Keep Going Up, But They Do Not Interfere With the Volume of Business—Scrap Prices Are All Marked Up This Week

THE question has been asked many times lately: When are prices going to break? A study of the steel, iron and machinery markets week after week would lead to the conclusion that such a happening is not seriously considered now. The problem is not a matter of price. It is a question of securing the material to fill the demand. This week prices for cast iron scrap were moved up to $33 per ton, and the chances are that a good tonnage would bring considerably over that mark. At the beginning of 1914 that same metal was being bought by dealers at $12 per ton. At that time bar iron was selling from Toronto warehouses at 2 cents per pound, while to-day the same places are quoting 5.50 per pound. Machinery dealers have ceased to be particularly interested by announcements of ten per cent. increases, and there are machines on which these increases will make a difference of a thousand dollars quite readily.

The march of prices has not put a peg into the volume of business that is offering. Inquiries are good, orders the same, and there is no trouble about collections.

The Leaside munition plant, the last in this district to survive in any shape, went out during last week to Toronto scrap dealers. They disposed of some of the machines, but at least 50 or 60 per cent. will be scrapped.

There is talk of some of the steel mills starting in to buy scrap on a fairly large scale now. In such a case they will have to compete with the American price for heavy melting steel. Some of them have been out of the scrap market in the hope that prices would ease off. However, they can hold out no more, and it looks as though they would have to buy and increase their costs.

Several of the large houses in this district stated this week that they could see nothing in the situation at present that hinted at any slowing up of industrial development. The demand was increasing rather than decreasing.

MONTREAL PORT GETTING IN SHAPE FOR COMING OF SPRING

Special to CANADIAN MACHINERY.

MONTREAL, Que., March 11.—There appears to be every indication that business in general is gradually getting back into its normal state of activity. Labor troubles are not affecting production as it did during the past six months, and the coming of spring may mark a beneficial development throughout the country. The storm and heavy snowfall of the past few days has seriously interfered with railroad operations, and transportation has been delayed in consequence. Preliminary preparations are being made for resuming marine activities at the port here, but nothing definite can be said as to the date of the opening of navigation. The ice on the river is quite thick this year, and even with the aid of the two Government ice-breakers, the clearing of the river will entail no small amount of work.

Canadian shippers of goods to the United States will likely have to content themselves with the ruling of the railways in their regulations regarding prepayment charges. The Board of Railway Commissioners has decided not to interfere with the action of the railways, so that, for the time being, charges on goods shipped to the United States will be collected at destination. The board has likewise given an important decision regarding the application of shippers for the adoption of the average demurrage system as operated in the States. The board has decided to continue the demurrage rates as now effective.

Steel Demand Increases

The change in the American railway policy has already resulted in a refitting programme that was expected to develop in consequence of the Government relinquishing control. This has not been confined to the States, as Canadian roads during the past week or two have been heavy purchasers of railway equipment. The total business for Canadian roads runs well up to $50,000,000. Canadian steel mills are very active at the present time and the demand for every class of material continues heavy.

The new steel mill of the Dominion Steel Corporation is now an active producer of plate, so that less dependence will be placed on the American mills for Canadian requirements of heavy plate. There is a feeling that, with the successful operation of the Dominion plate mill the producers in the States will be more considerate in the delivery of this class of material to Canadian consumers. There is still a marked scarcity of sheets and early supplies are generally obtained on the premium basis. Little warehousing of sheets is yet possibie. The same condition virtually obtains in tubes and the recent advances reflects the strong character of the current market. Sheets are now quoted at 8½ cents for both 10 and 28-gauge, this price representing an advance of $5 per ton over that of a week ago. Canada dull plates are now $9 per hundred. Nominal quotations are again given here on Premier galvanized sheets, the prices being 10½ cents and 11 cents for 28-gauge, and 10¾ oz. respectively. Plates are up again and the local quotataions are 7¼ cents for sizes up to 3-16 inch and 6½ cents for ¼ inch and upwards. An advance approximating 8 per cent. has been placed on several sizes of boiler tubes. Changes will be noted in the selected list.

Metals Firm on Steady Demand

The movement of the non-ferrous metals is steady but the volume of business is comparatively light. Railroad buying is expected in the near future. Copper demand is not active and a slightly weaker tendency is apparent.

Interest is still displayed in the tin situation but buying is only on the basis of urgent requirements. The market is a little easier at 76 cents per pound. Spelter is also lower, the quotation of 12 cents being a drop of ½ cent per pound. Other metals are firm and unchanged.

Machine Tool Outlook Improving

While the present volume of business cannot be said to have shown any marked improvement over past weeks, the outlook for the spring months is of a promising character as most dealers are anticipating extensive buying on the part of many industrial interests. The railways are expected to be in the market for considerable quantities of machinery to augment equipment that has been overworked during the post-war period. There has been a good general demand for machinery of every description and the movement of supplies has compared favorably with similar periods in former pre-war years. The upward climb of prices still features the market and the buyer of tools is frequently surprised when a repeat order goes through at the previous figure. The volume of used tools that are being disposed of marks the evident inability to secure new machines, and this is accountable, partly, by the high cost to the buyer of American machinery.

Scrap Looks Better

While dealers cannot report an actual improvement in trade, they are nevertheless looking forward for better buying before the month is out. This is the general impression of some of the dealers here as a result of the increased activity that is developing in all lines of industry. The demand for machine cast iron cannot be adequately supplied and almost any price can be obtained for this material. "The market is almost without a price and that quoted is as good as any." This remark by a dealer signifies the character of prevailing conditions. The iron and steel market is more active than the non-ferrous scraps. Prices are unchanged and nominal.

ONLY LIMIT NOW IS TOOL SUPPLY

Demand is Good, But Securing of the Goods is Another Matter—Scrap Metals Are Up

TORONTO.—One dealer, sizing up the situation, brought out something that gives a pretty fair index to trade conditions in the machine tool line. His point was, "The way business is going just now makes it almost impossible to train salesmen for machine tool lines. About six to ten years ago we had to get out and hustle for business. A prospect was something and the signed orders was another. But it is all different now. All that is necessary is that the salesman be able to tell the prospect that he knows where he can get a machine for him."

It is a fact that the shortage of machinery and the sustained demand have helped to bring business to a peculiar basis in this country.

Dealers, at the same time, generally recognize that these are abnormal conditions, and they are not altering their sales policies to any extent. They realize that they have to keep before the trade, for the time will undoubtedly come sooner or later when they will find it necessary to get out and chase business as they had had to do in the past.

The question was asked of several of the machine tool dealers in Toronto this week if they could see anything in sight that would indicate a holding-up of the demand for machine tools, or for the other lines they were handling. In every case the answer was the same, and that was that the only thing that was holding up trade was their inability to get the goods to meet the demand.

A few more notices have come through during the week, regarding the process of machine tools. These are accepted as a matter of fact now, although a ten per cent. boost on top of some of the machines that run into some thousands of dollars means money.

The machinery in the old Leaside munition plant, the property of the U. S. Government, went under the hammer a few days ago. Most of it was taken in by Frankel Bros., and, according to a statement by that firm, a good bit of it will go for scrap metal. There is a decided scarcity for anything that has any weight of cast iron.

POINTS IN WEEK'S MARKETING NOTES

Increases were marked up all through the scrap metal prices this week. The difference between old and new prices is particularly marked in the iron and steel prices.

It is likely that some of the steel mills will be coming into the market more than for some time past, and the chances are that they will have to pay a pretty stiff price for their supplies of heavy melting steel.

The base prices on iron and steel bars, which covers a large variety of material, have been raised in Toronto to 5.50, a high mark for some time.

Dealers, speaking of the high levels of steel, now predict further increases, claiming that they cannot see where a drop can come in the present condition of the market.

Machine tool trade states that it can see no let-up in the demand for equipment, the big problem being in securing the goods to meet the demand.

New York depends largely on the railroads now to come in and keep up the demand for machine tools in a large way.

The last of the Leaside munition plant went to Toronto scrap dealers —at least the great bulk of it did. Some of the machines have been disposed of, but fifty or sixty per cent. will be scrapped.

Many Prices Advanced

The steel trade marked up a good many items this week. The base price on iron and steel bars is now at $5.50 at practically all the jobbers in this district. There has been for some time a change in effect for the selling of cold rolled shafting. The old list that has been worked on for some time was prepared in pre-war days, and was not at all representative of conditions now. It made the dealers and mills take the position of raising the figure they would have to add to the list all the time. This really became a top-heavy way of doing business, and it was a rather complicated affair. The plan employed at present by dealers here is to put $6.25 per pound base. For lots of less than 1,000 pounds there is an extra of 35 cents, making $6.60. The base size is 2¼ in. to 3 in. Anything outside of that scope comes as an extra for size.

There is a fairly good tonnage moving in certain lines. As a general thing, though, considerable of the material that is coming in now has been bought at quite a premium in order to secure delivery. The firms receiving this are not anxious to take it into stock, hence the movement is quick, in and out again, and as a result the warehouses are as bare as ever, although certain of the manufacturers may be better off—but at a price.

When will prices cease to rise? Here is the answer of one Toronto steel man: "We look for still higher prices." It is a fact that some of the Canadian steel mills will have to purchase scrap before very long. Some of them have held out for quite a while, hoping that prices would sag in the meantime, and in this way they would not have to increase their selling prices. It begins to look as though, were they to come into the market now, they will have to meet the U. S. prices, and it must be remembered that exchange is quite an inducement to sell into the American market just at this time.

Small Tools Are Busy

There is a nice line of business in small tools and supplies generally. Prices, since the last advances, remain firm. Some fairly heavy buying was done in the last week or so, as buyers who watched market reports closely knew that price changes were coming. One dealer had quotations in with a concern that does not take kindly to price changes after a bid is in. He had put in his price on the old figures, and learned shortly after that prices were going to move. He took a chance on securing the business and placed the order to get the price. He was awarded the business as he expected, and was in this way able to fill it and still have his margin of profit.

General Advance in Scrap

All classes of scrap iron and brass and coppers went up in the scrap market this week. There is nothing to show any improvement in the cast iron or stove plate situation. In fact there is a greater demand than previously for iron and steel. The steel mills in some cases are in the market again, and they buy in large tonnage. The call for material for the steel mills has been somewhat hung up lately in the hope that the peak of prices might be passing. The result is that when they do come in now they will find that they will have to face a market that is fairly well depleted. Heavy melting steel is hard to obtain and any holders that may have some in stock, if there is a stronger demand for it, may ask their own good price and be fairly certain that they will get it. The breaking down of the last of the munition plants is sending a certain tonnage of scrap to the yards, but many of the machines that are scrapped are of the lighter variety, so that the total is not very much.

RAILROADS LOOKED UPON AS THE BEST PROSPECTS IN U.S. TOOL TRADE

NEW YORK, March 11.—Although inquiries for machine tools have fallen off in the East, and to some extent in other sections of the country, a good volume of business is still being done in certain lines. Railroad business is looming up as an important factor. This week the American Car & Foundry Co. is placing large orders for all of its plants against a list issued two or three months ago. The New York, New Haven & Hartford Railroad, which has inquired for 21 engine lathes and 14 radial drills, is expected to close very soon for this equipment. The Pennsylvania Railroad, which has received a great many quotations in the past two or three months for estimating purposes, may close soon on a quantity of tools for its shops at Trenton, N.J. The railroads are sure to buy large numbers of locomotives and cars and the makers of such equipment, together with those who make parts and accessories, will before the end of the year be rushed with work. It goes without saying that many of them will need to renew their machine tools. Deliveries on tools are so far extended that some of the roads have come into the market to see what can be procured in used tools that will satisfy urgent needs. Makers of the special railroad tools, such as axle lathes, journal trueing lathes, car wheel and driving wheel lathes, car wheel borers, hydraulic wheel presses, etc., are rushed with other work and there is doubt as to how soon the needs of the railroads for this class of special equipment can be filled if the demand should develop into large proportions.

A large buyer of the past week is the Federal Shipbuilding Co., Kearney, N.J., which is now equipping some of its shops which were built during the war, but not completed, equipped at that time. Most of its purchases are large tools, orders having been placed for a 16-ft. planer costing about $80,000 and an 80-in. lathe.

There is a good demand from Canada for second-hand tools and quite a number of sales have been made for shipments to your side of the border. Orders for used tools are coming in at a good rate, the long-deferred deliveries of new tools forcing manufacturers to satisfy their requirements, when urgent, by taking whatever can be had the quickest.

The Columbia Graphophone Co., Bridgeport, Conn., has placed more orders for its Toronto and Baltimore plants. This, it is believed, about completes its buying, which has been of large proportions.

The Chapman Valve Mfg. Co., Indian Orchard, Mass., is in the market for considerable new equipment.

The American Brass Co. has purchased eighteen small cranes from the Pawling & Harnischfeger Co., Milwaukee, Wis.

U.S. SCRAP METAL

The pig iron market is somewhat unsettled, some districts reporting good sales, while others are dull. Following are reports from various U. S. points:

PHILADELPHIA.—There have been some good-sized tonnages of heavy melting and steel scrap during the week. A Pittsburgh interest bought 20,000 tons heavy melting steel at $29, delivered, while other sales varied from $26.50 to $25 delivered. Wrought iron pipe is at $25.50, delivered. Stove plate has brought $33, delivered.

BOSTON.—The car situation is preventing much business being done from New England points, and some of the roads which are still accepting shipments are unable to give deliveries. A small lot of cast scrap was sold at $47, delivered, and a few hundred tons of heavy melting steel at $43.40 shipping point.

NEW YORK.—The market is dull, and prices are inclined to drop, stocks being plentiful. Consumers are receiving delayed shipments as the railway situation has improved during the last week.

BUFFALO.—Some heavy sales have been made of heavy melting steel for delivery to Pittsburgh, the price being equivalent to $26.10, Buffalo, or $29, delivered, Pittsburgh. Cars are more plentiful.

PITTSBURGH.—After some activity caused by a large interest buying a good quantity of heavy melting steel, the market has settled down to dullness again. This has extended to the foundry grades, and a slight drop in price is apparent over the whole range

CLEVELAND.—The market is weak, a slight reduction having occurred in many grades. Heavy melting is now at $25.50 to $26. Old steel rails and drop forge flashings have dropped $1 50 and 75 cents. Snow melting steel has been bought in the valley at $27.

CHICAGO.—The market reveals a little better sentiment, although prices are still slightly on the decline. The labor situation is bad, and some railroad lists have had to be withdrawn on account of it being impossible to get men to load the cars.

ST. LOUIS.—Trading is light and the market is weak, but there has been no drop in prices. Mills and foundries are running to capacity, and this feature tends to improve the situation.

PIG IRON TRADE

Although there has been good buying in some quarters, the general tone of the market has been quiet. New England melters are facing a serious situation by reason of the continued embargo on iron. Following are reports from various centres:

CHICAGO. — Although there is a period of quietness just now, a further large buying movement is expected to materialize before long. 1.75 to 2.25 silicon foundry iron is now quoted $43 furnace, last half delivery.

PHILADELPHIA.—There has been an active buying week in this district, the price being $43 to $44 Eastern Pennsylvania furnace for 1.75 to 2.25 silicon and $44.25 to $45 for 2.25 to 2.75 silicon. Bessemer has been sold for export to Italy at $45 Eastern Pennsylvania furnace.

PITTSBURGH.—There has been a good quantity of basic iron sold at $41.50 valley furnace basis, for March and April delivery. The $43 price does not seem to be sustained, though some prompt iron was sold at this price furnace.

CLEVELAND.—Basic is in strong demand, and is firm in price. $43 furnace seems to be the minimum. Foundry iron is $42 to $43 furnace for 1.75 to 2.25 silicon, for last half, but iron for prompt shipments is quoted at $45 furnace, and very little available.

BOSTON.—The embargo on iron entering New England points is still in force, with the result that resale iron is reaching high figures. 2.25 to 2.75 silicon has sold at $60 on this basis. Iron for last half is quoted for No. 2 X at

$49 delivered, or $46.25 Eastern Pennsylvania furnace.

NEW YORK.—There has been an awakening of the market following the quiet of last week. Prices retain the same level, $43 for 1.75 to 2.25 silicon Eastern Pennsylvania furnace. Most of the iron was for early or spot delivery, and a good deal of the buying was by melters who find they have underestimated requirements.

BUFFALO.—Although most makers are supposed to have sold their product for the rest of the year, a fair tonnage of iron was sold during the week. The sales were on a basis of $45 for No. 2 foundry, with $46.25 and $48 for the next two grades. Canadian Steel Foundries of Hamilton are in the market for 10,000 tons basic, the last sale of this grade being at $44.

ST. LOUIS.—There is not very much enquiry, and furnaces are accumulating some iron in their yards, due chiefly to the car shortage. No. 2 Southern iron is quoted from $40 to $43 for 1.75 to 2.25 silicon.

BIRMINGHAM.—The selling market is quiet, and furnaces are trying to get production and delivery on a better basis. Illness among the workmen and the car shortage is causing great trouble.

MUST CONSERVE OUR NATIONAL RESOURCES IS WARNING GIVEN

In his presidential address to the Canadian Mining Institute at the opening of their twenty-second annual meeting in Toronto on March 8, D. H. McDougall sounded a note of warning and made a plea for the conservation of our natural wealth. While Canada has great natural resources, she has none to waste, and the former idea of the inexhaustible nature of our minerals, timber and coal must be modified in the light of our ever-increasing population. It was accordingly necessary to take stock of available resources and "cut the cloth accordingly."

The speaker pointed out the situation in Canada with regard to the three basic sources of wealth and industry, coal, iron and wood. Our coal deposits do not include anthracite, except in small quantities, and although we have large quantities of excellent bituminous coal in the Maritime and Pacific Provinces, the central portion of Canada is almost totally dependent upon the United States for its coal supply.

D. H. McDOUGALL,
President C.M.I.

The iron ore situation in Canada was unsatisfactory from many points of view. They were, in many cases, of low iron content and unsuitable for reduction by present methods. Their future will thus, in large measure, depend upon the advancement of science. Our timber resources were rapidly vanishing and Canada's position in this respect was indeed alarming, but as an offset to this, Mr. McDougall emphasized Canada's advantage in having control of the world's supply of nickel, cobalt and asbestos.

When the convention opened the Hon. Harry Mills, Ontario Minister of Mines, welcomed the institute on behalf of the province, while Mayor Church extended similar courtesies on behalf of the city of Toronto. Thomas W. Gibson, Deputy Minister, presented a summary of the mineral production in Ontario for 1919, which exceeded that for 1913 by $4,349,802. R. E. Hore, consulting geologist, urged greater Governmental publicity as to the exact conditions and prospects in mining in Ontario.

The afternoon session Monday was given over to a number of technical papers, together with a report by Dr. Goodwin on the activities of the educational committee. W. H. Collins gave an interesting paper on the iron ranges of the Michipicoten district in Ontario. The Helen mine has been the largest producer in Ontario, having been worked since 1919, but it is now exhausted. Steps are being taken to develop the adjoining property, which contains, at a conservative estimate, 100,000,000 tons of ore. The mining and treatment are no longer in the experimental stage, since the Magpie mine has been in operation since 1913 and valuable experience been gained. Siderite ore consists of carbonates of iron, calcium, magnesium and manganese and calcination; by driving off the carbon dioxide gas raises the iron content from 35 to about 55 per cent. Other siderite deposits, while of no economic importance at the present time, will prove valuable later on.

The iron formation is of much interest geologically, and the geologist is able to give valuable aid to the prospector and miner.

Major Percy Barbour, of New York, gave an address on "What the Mining Engineer Did in the U. S. During 1919," and stated that his work had apparently little to do with the strictly engineering side of mining, but was connected with various other aspects of the industry. The speaker dealt with the licensing of engineers in the United States, and with other points of contact between the Government and the engineer. He also spoke of the labor difficulties under which the engineer was laboring.

One instance cited by Major Barbour was that of the Miami Copper Company, who were under the necessity of cutting wages or curtailing hours of work, and by the expedient of calling in the shift bosses the matter was satisfactorily explained to the men and carried through.

M. E. Wilson read a paper on Molybdenite in the Ottawa Valley, and the paper, together with the lantern slides, gave a wealth of information concerning this mineral.

At the evening session on Monday the members were shown lantern slides, showing the mining and smelting operations of the International Nickel Company of Canada, and moving pictures of underground operations at the Cobalt silver fields and of the operations at the Alfred peat bog.

The convention continued during Tuesday and Wednesday, and trips were arranged to the Port Colborne refinery of the International Nickel Company of Canada and to the Toronto plant of the Goodyear Tire and Rubber Company.

Other papers read during the convention were:

"Coal Mining Industry in the Province of Alberta," by J. T. Sterling; "Fuel Problems of Western Canada," by W. J. Dick; "Coal Supply of Canada," by F. W. Gray; "Lignite in Saskatchewan," by A. McLean; "Briquetting Industry," by E. Stansfield.

"Future Prospects for Oil and Gas Production in Ontario," by M. Y. Williams; "Natural Gas in Ontario," by E. S. Setlin; "Oil Possibilities in Western Canada," by D. B. Dowling; "Oil Problems in Canada," by T. O. Bosworth.

Discussion on Institute's Prospecting Scheme, following an address by J. A. Campbell, M.P., on "Attitude of Canadian Governments toward Mining Development"; "Britannia Mines, British Columbia," by S. J. Schofield; "Progress Notes on the Investigation of the Quebec Asbestos Deposits," by R. Harvie and E. Poitevin; "Asbestos Mining," by J. G. Ross.

Discussion on nickel coinage: "Lost Placers of Ontario," by A. P. Coleman; "Recent Developments in Mining in Northern Ontario," by J. G. McMillan; "Geology of Silver Islet and Vicinity," by T. L. Tanton; "The Nipissing Mine," by H. Park; "Minerals of Eastern Ontario," by J. W. Evans.

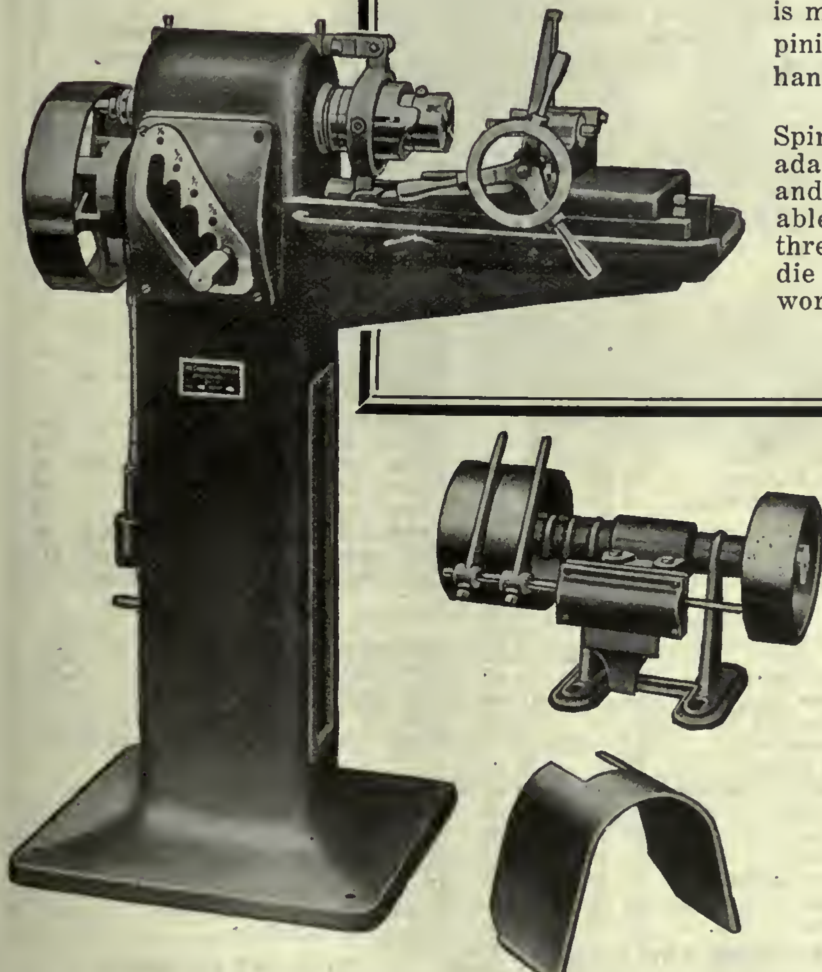
THE GEOMETRIC WAY

Where quantity and exactness have to be considered, the Geometric Threading Machine is just the way that suits. These machines have been tested and proved over and over again on speed, accuracy and endurance.

Geometric Threading Machines are employed on a large class of small threaded parts that cannot be produced economically on the ordinary screw machine.

Made in three sizes—to cut 1/8 to 1/2 inch, 1/4 to 3/4 inch, and 3/4 to 1 1/2 inch diameter threads. The carriage is mounted on slides and on the largest size machine is moved back and forth by rack and pinion, and in the smaller sizes by hand.

Spindle speed changes readily made, adapting the machine to the diameter and material of the work. An adjustable stop assures accurate length of thread, and automatically opens the die head, permitting of drawing the work straight back.



A line from you brings full details regarding this machine. Tell us your threading requirements — let us recommend the proper Geometric Collapsing Tap or Self-opening Die.

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Williams & Wilson, Ltd., Montreal. The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg, St. John, N.B.

Canadian Fairbanks-Morse Co., Ltd., Manitoba, Saskatchewan, Alberta.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$42 40
Lake Superior, charcoal, Chicago	57 00
Standard low phos., Philadelphia	50 00
Bessemer, Pittsburgh	43 00
Basic, Valley furnace	42 90
Toronto price:—	
Silicon, 2.25% to 2.75%	52 00
No. 2 Foundry, 1.75 to 2.25%	50 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 50
Steel bars, base, Toronto	5 50
Iron bars, base, Montreal	5 50
Steel bars, base, Montreal	5 50
Reinforcing bars, base	5 00
Steel hoops	7 00
Norway iron	11 00
Tire steel	5 75
Spring steel	10 00
Band steel, No. 10 gauge and 3-16 in. base	6 00
Chequered floor plate, 3-16 in.	9 40
Chequered floor plate, ¼ in.	9 00
Staybolt iron	9 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	4 00
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 90
Small shapes under 3"	3 62

FREIGHT RATES

Pittsburgh to Following Points	Per 100 Pounds. C.L.	L.C.L.
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

	Gross. Montreal	Toronto
Lake copper	$25 00	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	77 00	76 00
Spelter	12 50	12 00
Lead	12 00	12 00
Antimony	14 50	14 00
Aluminum	34 00	35 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 7 25	$ 7 25
Plates, ¼ up	6 50	6 50

Price List No. 38

WROUGHT PIPES

Standard Buttweld

⅛ in.	$ 6 00	$ 8 00
¼ in.	4 68	6 81
⅜ in.	4 68	6 81
½ in.	6 21	7 78
¾ in.	7 82	9 95
1 in.	11 56	14 71
1¼ in.	15 64	19 90
1½ in.	18 70	23 76
2 in.	25 16	32 01
2½ in.	40 37	51 19
3 in.	52 79	66 94
3½ in.	67 16	84 18
4 in.	79 57	99 74

Standard Lapweld

2 in.	38 81	35 34
2½ in.	42 12	52 36
3 in.	55 08	68 47
3½ in.	69 00	86 94
4 in.	81 75	103 00
4½ in.	93	1 18
5 in.	1 08	1 37
6 in.	1 40	1 78
7 in.	1 83	2 32
8L in.	1 93	2 44
8 in.	2 22	2 81
9 in.	2 66	3 36
10L in.	2 46	3 12
10 in.	3 17	4 02

Terms 2% 30 days, approved credit.

Freight equalized on Chatham, Guelph, Hamilton, London, Montreal, Toronto, Welland.

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.
4½" and larger 50%.
4" and under, running thread, 30%.
Standard couplings, 4" and under, 40%, 4½" and larger, 20%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$15 00	$14 00
Copper, crucible	18 00	18 00
Copper, heavy	18 00	18 00
Copper wire	18 00	18 00
No. 1 machine composition	16 00	17 00
New brass cuttings	11 00	11 75
Red brass cuttings	14 00	15 75
Yellow brass turnings	8 50	9 50
Light brass	6 50	7 00
Medium brass	8 00	7 75
Scrap zinc	6 50	6 00
Heavy lead	7 00	7 75
Tea lead	4 50	5 00
Aluminum	19 00	20 00
	Per Ton	Gross
Heavy melting steel	18 00	18 00
Boiler plate	15 50	15 00
Axles (wrought iron)	22 00	20 00
Rails (scrap)	18 00	18 00
Malleable scrap	25 00	25 00
No. 1 machine cast iron	32 00	33 00
Pipe, wrought	12 00	12 00
Car wheels	22 00	26 00
Steel axles	22 00	20 00
Mach. shop turnings	11 00	11 00
Stove plate	25 00	25 00
Cast boring	12 00	12 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜" and less	15
Carriage bolts, 7-16 and up	Net
Coach and lag screws	30
Stove bolts	50
Wrought washers	50
Elevator bolts	5
Machine bolts, 7-16 and over	10
Machine bolts, ⅜" and less	20
Blank bolts	25
Bolt ends	10
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square blank	add $1.50
Nuts, square, tapped	add 1 75
Nuts, hex., blank	add 1 75
Nuts, hex., tapped	add 2 00
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	40
Sq. and Hex. Head Cap Screws	35
Rd. and Fil. Head Cap Screws	5
Flat But. Hd. Cap Screws	10
Fin. and Semi-fin. nuts up to 1 in.	35
Fin. and Semi-fin. nuts, over 1 in., up to 1½ in.	25
Fin. and Semi-fin. nuts over 1½ in., up to 2 in.	10
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws, list plus 20,	30
Thumb screws	40
Thumb nuts	75
Patch bolts, add	20
Cold pressed nuts to 1½ in., add	$1 00
Cold pressed nuts over 1½ in., add	2 00

BILLETS

	Per gross ton
Bessemer billets	$60 00
Open-hearth billets	60 00
O.H. sheet bars	76 00
Forging billets	56 00-75 00
Wire rods	52 00-70 00

Government prices.
F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 70
Cut nails	5 85
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¾
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 32
British Manila rope	0 26
New Zealand hemp	0 26
Transmission rope, Manila	0 43
Cotton rope, ¼-in. and up	0 80

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net

MISCELLANEOUS

Solder, strictly	$ 0 40
Solder, guaranteed	0 39
Babbitt metals	18 to 70
Soldering coppers, lb.	0 58
Lead wool, per lb.	0 14
Putty, 100-lb. drums	6 75
White lead, pure, cwt.	17 80
Red dry lead, 100-lb. kegs, per cwt.	16 50
Glue, English	0 35
Tarred slater's paper, roll	1 30
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls., gal.	1 50
Linseed oil, raw, single bbls.	2 90
Linseed oil, boiled, single bbls.	2 92
Plaster Paris, per bbl.	4 50
Sandpaper, B. & A.	List plus 43
Emery cloth	List plus 37½
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 07
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 50

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes	32½
Can. carbon cutters, plus	20
Standard drills, all sizes	32½
3-fluted drills, plus	10
Jobbers' and letter sizes	32½
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	net
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus 20 to	40
Can. high speed cutters, net to plus	10
American plus	40

COLD ROLLED SHAFTING

At warehouse .... 6.25 base

IRON PIPE FITTINGS

Malleable fittings, class A, 20% on list; class B and C, net list. Cast-iron fittings, 15% off list. Malleable bushings, 25 and 7½%; cast bushings, 25%; unions, 45%; plugs, 20% off list. Net prices malleable fittings; class B black, 24½c lb.; class C black, 15¾c lb.; galvanized, class B, 34c lb.; class C, 24½c lb. F.O.B. Toronto.

SHEETS

	Montreal	Toronto
Sheets, black, no. 28	$ 8 50	$ 8 50
Sheets, black, No. 10	8 50	9 00
Canada plates, dull, 52 sheets	8 50	10 00
Can. plates, all bright	8 60	9 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	11 00	....
Fleur-de-Lis, 28 B.W.G.	10 50	....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28, U.S.	11 50	9 50
Premier, 10¾ oz.	11 00	9 90
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ¼ in., $9.75; ⅞ in., $9.20; ¾ in., $9.30; ⅝ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	28 00
1¾ in.	31 50	30 00
2 in.	30 00	28 75
2¼ in.	35 00	29 00
2½ in.	42 00	35 75
3 in.	50 00	45 75
3¼ in.	.....	46 00
3½ in.	63 00	49 00
4 in.	85 00	62 50

Above prices advanced 5%.

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	24½
Palacine	27½
Machine oil, per gal.	40
Black oil, per gal.	15
Cylinder oil, Capital	58
Cylinder oil, Acme	45
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	$2 60
Union thread cutting oil, antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil, bbls. net	8

BELTING—No 1 OAK TANNED

Extra heavy, single and double	10%
Standard	10%
Cut leather lacing, No. 1	2 75
Leather in side	2 40

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 60
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	09
Pumice, ground	06
Emery glue	30
Tripoli composition	09
Crocus composition	12
Emery composition	10
Rouge, silver	60
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE

XXX Extra	19½	Atlas	17
Peerless	19	X Empire	15½
Grand	18	Ideal	16
Superior	18	X Press	14
X L C R	17		

Colored

Lion	15	Popular	12
Standard	13½	Keen	10½
No. 1	13½		

Wool Packing

Arrow	25	Anvil	15
Axle	20	Anchor	11

Washed Wipers

Select White	.11	Dark colored	.09
Mixed colored	.10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades... 15%

ANODES

Nickel	.58 to .65
Copper	.38 to .45
Tin	.70 to .70
Zinc	.18 to .18

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6 x 4 base	45 00	44 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 75	$11 50
Sheets, 3½ lbs. sq. ft.	10 50	11 00
Sheets, 4 to 6 lbs. sq. ft.	10 25	10 50

Cut sheets, ½c per lb. extra.

Cut sheets to size, 1c per lb. extra.

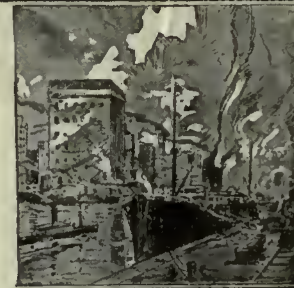
PLATING CHEMICALS

Acid, boracic	$ .23
Acid, hydrochloric	.03¼
Acid, nitric	.10
Acid, sulphuric	.03¼
Ammonia, aqua	.15
Ammonium, carbonate	.20
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, annhy	.41
Copper, sulphate	.16
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.08
Nickel carbonate	.32
Nickel sulphate	.19
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.25
Silver nitrate (per oz.)	1.20
Sodium bisulphate	.11
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.18
Tin chloride	1.00
Zinc chloride, C.P.	.30
Xinc sulphate	.08

Prices per lb. unless otherwise stated

INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS PERSONAL AND TRADE NOTES



TRADE GOSSIP

Increase Given.—A general increase of 10 per cent. to all employees was granted by Butterfield & Co., March 1, 1920. This affects office and shipping departments as well as the factory.

Baldwin's Take Out Permit.—Baldwin's, Ltd., the large tinplate firm which has located in the buildings of the British Munitions at Ashbridge's Bay, have received a building permit for the erection of a plate mill building to cost $200,000.

Another New Foundry.—The town of Georgetown has become the possessor of a new industry in the shape of the Central Foundry Co., which has commenced operations with a staff of 20 men. The president is A. L. Wynston, and the secretary-treasurer, H. J. Selfred.

Further Car Orders.—The Canadian National Railways have ordered from the Hart-Otis Car Co., Ltd., Montreal, 350 fifty-ton Hart convertible ballast and general service cars. These cars are for use in track maintenance and new line construction. The amount of the order will be $1,500,000.

Needle Works Changes Hands.—The F. W. Corey Needle Works, of Hamilton, has been acquired by the Canada Needle Works, and the business is being moved to Georgetown. A big extension of the Georgetown plant will be made, and the present capacity doubled.

Commutation Rates Suspended.—The Hon. F. B. Carvell has wired instructions to Mr. G. T. Bell, general passenger traffic manager of the Grand Trunk Railway, to suspend for the time being all increases in commutation and trip tickets. This order is to hold until the conclusion of the present investigation now being carried on by the Railway Commission. Similar instructions have been given the C.P.R.

Officers Elected.—At a recent meeting of the stockholders of the Buffalo Forge Company, new officers were appointed, as follows: Henry W. Wendt, president; Edgar F. Wendt, vice-president and treasurer; Henry W. Wendt, Jr., vice-president and secretary; C. A. Booth, vice-president and sales manager. The new directors include the above-named officers, and, in addition, Mr. H. S. Whiting.

A Big Incorporation.—The British Canadian Machine and Tool Co., Ltd., has been incorporated with a capital of $500,000, divided into 5,000 shares of $100. The new company have taken over the assets and goodwill of the International Machine and Tool Co. and the Reliance Motor and Tool Co., Ltd. The directors of the new company are Mr. Thomas L. May, Harry A. Newman and John Geo. Baukat. The business of the company is being caried on at present at 183 George Street and 111 Adelaide Street. They will probably erect an extensive plant in Toronto.

TUBE COMPANY TO START BUSINESS

Capacity of From 25,000 to 30,000 Feet Per Day—Investigation Covered Long Period

In our industrial news column of last issue, we gave a brief notice of the formation of a new company, to engage in the manufacturing of steel welded tubing. We are now able to give some further details of what is an absolutely new industry in the Dominion. The Tube Company of Canada, as the new firm is called, have premises at 233 Dufferin Street, Toronto. The process by which the tubes are made has been developed by the principals of the company, and is a combination of oxy-acetylene and electric welding, in the first instance, the tubes being drawn to size after welding and formed to the required shape, either oval, or round, or square. The capacity of the plant will be 25,000 to 30,000 feet per day, either hot or cold finish. The product will be used in the building of bedsteads, automobiles, aeroplanes, bicycles, farming implements, and similar articles.

The president, Mr. H. W. Carter, and the secretary-treasurer, Mr. P. Sorley, were pioneers of the welding business in Canada, and the making of the tubes will be carried on under their close personal spervision. The general manager, Mr. J. F. Lawson, has had a wide experience in the United States and Canada in tube and metal work, and for the past nine years was superintendent of the Pedlar People, Oshawa. The company, before starting to manufacture, have been carrying on investigations and experiments for the past four years.

Received Orders.—A representative of the Robb Engineering Works, Amherst, speaking of conditions there, said: "We have at present under construction in our shops an order for fifty "Tillsoil" tractors. Ten of these have been ordered by the Highway Commission of the Province of Nova Scotia, and the balance is for the Canadian North-West. Special tools and equipment have been installed for the manufacture of these tractors in order to ensure a large output. We have also received an order from the Rock Plaster Manufacturing Co. of New York for a 150 h.p. tubular boiler and a 150 h.p. Robb, Armstrong engine for their new plant at Walton, N.S."

Woodstock Industry.—Standard Tube & Fence Co., Ltd., of Woodstock, Ont., have acquired the Canadian patents of Marshall B. Lloyd, covering acetylene and electric welded tubing, and have formed a close working arrangement with the Standard Parts Company of Cleveland, Ohio, to manufacture many of the latter's line of welded products. The Standard Tube Co.'s product has heretofore been confined to close joint tubing, but with the purchase of the Lloyd's patents will now be in a position to supply welded tubing required by the automobile, bicycle, bedsteads and other trades. Extensive additions to the plant in Woodstock are contemplated for this spring. Meanwhile equipment is being installed in its present buildings and the company expects to be ready in a few weeks to deliver the first welded tubing of this kind made in Canada.

MARINE

New York.—Keeping in wireless communication with a station in the United Kingdom during the whole trip across to the United States is the record achieved by the "Imperator" on a recent trip. The station was at Aberdeen, Scotland.

Toronto.—After thirty-two years' service with the Toronto Ferry Co., Capt. Bob William is retiring from active life. During the whole of this time he has been engaged in the transportation of passengers between the city and the Island, and has never had an accident. The captain is 78 years of age, and was born at Oakville. In recognition of his services, he will be retired on full pay.

Toronto. — As soon as navigation opens, it is the intention of Deputy Harbor Master Allen to hold a life-

In analyzing your shop costs have you considered a possible saving in your tool room?

How Many Prices Are You Paying for Making Your Tools?

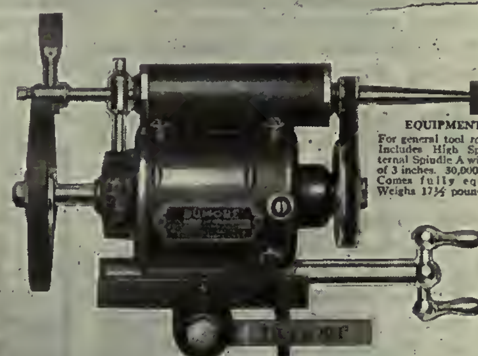
An analysis of the operation of departments from a "dollars and cents" point of view, and particularly those departments directly affecting production, invariably discloses abnormal costs.

One sure means of reducing costs and, at the same time, of obtaining highest quality tools, is found in the **DUMORE** portable grinder. The two chief reasons for this are balance and speed. The perfect running balance eliminates vibration and chatter—the big range of speeds from 10,000 to 50,000 R. P. M. gives even the small wheels the correct cutting speed, thus insuring work free from taper or bell-mouth. In addition to these reasons, the **DUMORE** is portable, permitting the mechanic to carry it to the many jobs being constantly set up in all parts of the shop.

Your dealer sells **DUMORE** grinders. Ask him for a demonstration.

WISCONSIN ELECTRIC CO.

2919 16th Street RACINE, WIS.



EQUIPMENT A
For general tool room use. Includes High Speed Internal Spindle A with reach of 3 inches. 30,000 R.P.M. Comes fully equipped. Weighs 17½ pounds.

EQUIPMENT B
For deep internal work. Extension arm has 10-inch reach. 10,000 R.P.M. Arm interchangeable with internal spindle on Equipment A.

EQUIPMENT C
For button dies. Will grind 20 an hour. Interchangeable with A and B.

DUMORE HIGH SPEED GRINDERS

If interested tear out this page and place with letters to be answered

saving demonstration along the water-front through the medium of the life-saving crew. All the men employed on dredges and boat-houses will be brought together, and given a lesson in the manner of handling a person who has fallen in the water, and the methods of resuscitation after the rescue is made.

Ottawa.—Mr. J. E. Armstrong, M.P. for East Lambton, has given notice of a bill to amend the railway act, which would bring all lake steamship traffic under the jurisdiction of the Railway Commission. This bill has been up before on several occasions, but has been defeated. Mr. Armstrong is also seeking the appointment of a commission to govern all steamship traffic between Canada and the United Kingdom.

Ottawa.—The Deputy Minister of Marine and Fisheries in speaking of the report that the steamer Montcalm was in a critical state, due to ice pressure in the Gulf of St. Lawrence, remarked: "There is absolutely no truth in this statement." He went on to say that the two men quoted in the report of the steamer's critical condition had deserted from the Montcalm, and were probably trying to justify this action on their part. Captain Hearn, who is in charge of the Montcalm, and Captain Reid, who commands the Prince Edward Island car ferry, are among the best officers in the world as far as ice service is concerned, and Mr. Johnston said that the former would, without doubt, have advised the department immediately if his vessel was in very serious danger.

The last report received by the department is to the effect that its conditions are now a little easier, and that the Montcalm has sighted open water for a distance of about ten miles. She is trying to reach the Magdalen Islands with a cargo of supplies for the inhabitants.

The crew of the Montcalm numbers 64 men all told.

PERSONALS

Fifty-eight years in the service of the Grand Trunk and still at work is the record of Mr. George Clark, foreman of the blacksmith shop at the Stratford works of the railway. Mr. Clark, who has been receiving the congratulations of the officers of the company, is enjoying the best of health and is attending to his duties with the same regularity that he has shown throughout his long career with the road. Mr. Clark's father was also with the Grand Trunk, being employed at the Point St. Charles shops and having come to this country with Messrs. Peto, Brassey and Betts, in connection with the building of the Victoria Tubular Bridge over the St. Lawrence. It was at Point St. Charles that Mr. George Clark entered the railway's service in 1862, but he has been stationed at Stratford since 1871.

BAWDEN MACHINE CO., LTD., TORONTO, ACQUIRE ENGLISH LICENSES

Following three visits to the United Kingdom by Mr. A. G. Hill, and negotiations which have covered a year, arrangements have been completed by which the Bawden Machine Co., Ltd., of Toronto, will manufacture under license several well-known varieties of British machinery. They will keep on hand a large stock of parts for repair of machines already erected here, thereby obviating the necessity of sending to England with the accompanying delay. This difficulty has often stood in the way of making sales of British machinery in Canada, and the new arrangements should be a great help to the sales efforts of the firms included in the agreement. The Bawden Co. will build up a competent engineering sales staff, and Mr. Hill is of the opinion that a very good business can be built up, especially under the present exchange rate, which is favorable to developing trade with English firms.

The firms whose lines will be carried will include some of the best known manufacturers in the United Kingdom, whose names carry a guarantee of excellence. They are Robey & Co., Lincoln, England, manufacturers of steam and oil engines, of the stationary and portable types, and boilers; Alley & McLennan, Ltd., Glasgow, Scotland, makers of air compressors, steering gears and water works supplies; John Thompson, Ltd., Wolverhampton, Eng., makers of water-tube boilers and corrugated furnaces; David Bridge & Co., Ltd., Castleton, Eng., makers of the Bridge clutch, rubber and textile making machinery; E. S. Hindley & Co., Ltd., Bourton, Dorset, Eng., high-speed steam engines; Brown Bros., Ltd., Edinburgh, Scotland, makers of telemotors, steering gears and marine auxiliaries; Bow McLachlan, Ltd., Paisley, Scotland, making the same lines.

The Bawden Company will continue the manufacture of the lines they have been making for several years, including pumps, valves, hydrants, rubber mill supplies, printing presses and automatic machinery and hydraulic presses. The new venture should ensure an era of continued prosperity for this enterprising firm.

The Return of the Railroads

Darling in the New York "Tribune."

The American railroads were this week returned to private control by the Government.

If interested tear out this page and place with letters to be answered

The Week's Events in Montreal Industry

After conferring with representatives of the different freight departments, the Board feels that interference would not be justified at the present time. Therefore, prepayment of charges on goods going to the States will not be accepted by Canadian roads.

* * *

Following the protest of many Canadian shippers on the action of the railroads, asking for freight charges to be paid at destination, the Canadian Board of Railway Commissioners has decided not to interfere with the policy of the railroads.

* * *

R. W. Ashcroft, formerly advertising manager of the Canadian Consolidated Rubber Co., and for the past four years in a similar capacity with the United States Rubber Company, has been appointed director of publicity of the Ames, Holden, McCready System.

* * *

The return of the American railroads to the control of the respective companies has necessitated important administration changes in many instances. H. E. Whittenberger has been promoted to the position of general manager of the Grand Trunk lines west of Detroit and St. Clair River.

* * *

The Dominion Welding Manufacturing Co., of 576 St. Timothee St., will build a new plant on the present site to take care of their increasing business. They will manufacture the Presto instantaneous water heaters for domestic and industrial use. At present their activities will be devoted to the smaller size for house service, but eventually they will make the larger units for factory and manufacturing purposes.

* * *

W. R. Davidson, who has been general superintendent of Eastern lines for the past two years, will be transferred to a similar position on the Western division. R. H. Fish will take the position of general superintendent for Eastern lines. These changes will become effective immediately.

* * *

D. B. Hanna, president of the Canadian National Railways, has just announced the appointment of William Phillips, director of the Robert Reford Co., to the position of European manager of the C.N.R. and C.G.M.M., with headquarters in London. Mr. Phillips returns to an office that is not new to him, as he was in charge of the C.N.R. European business before the inauguration of the merchant service.

* * *

The McCormick Machinery Co. of Montreal, has leased a two-storey brick building at 58 Prince St., which the company is using for a storage warehouse for a large part of their present stock. A portion of the ground floor will be reserved for a machine shop for the repairing and rebuilding of used equipment. In a short time the offices of the company will be removed from the present location, 30 St. John St., to the warehouse site.

* * *

The decision of Sir Auckland Geddes to accept the office of American Ambassador to Washington, necessitated the resignation of the principalship of McGill University, to which office he was appointed some months ago, and while he was still in the service of the British Government. Nothing definite has been done towards filling the vacancy at McGill, but it is rumored that several names of distinguished scholars in the United Kingdom have been mentioned for the position.

* * *

Another milestone in the progressive development of the telephone was passed last week when through conversation between Montreal and Winnipeg was successfully carried on by L. B. McFarlane, president of the Bell Telephone Co. of Canada, and his son, H. B. McFarlane, in Winnipeg. The demonstration was made at the Mount Royal Club in Montreal before a gathering of interested parties. Several days will be required to place this new long distance service in practical operation.

Due announcement will be made by the telephone company when the new service is open for business.

* * *

D. B. Hanna, president of the C.N.R., in an address before the Canadian Club at Ottawa, predicted a rosy future for the Canadian roads. He does not anticipate any repetition of disastrous consequence as a result of the Government taking on additional railroad responsibilities, but believes that the acquirement of the roads will be of an entirely beneficial character. He stated that the United States had taken possession of the railways as a war measure, while in Canada the roads were taken over for economic reasons. The object of the U. S. was to effect unified service during the war, regardless of cost. In Canada, he stated, they were taken over for adequate and efficient service. Politics will be kept out of the administration affairs of the roads.

The "Labor Gazette" (February) says: The lockout of moulders at Brantford, and the strikes in the moulding trade at Sherbrooke and Toronto, which commenced on May 1, September 23 and May 1, respectively, were still unterminated, although in all three disputes most of the orignal strikers had secured work elsewhere. The strike of shipbuilders at Sorel, which commenced on August 12, was also unterminated. Four strikes in this group commenced during January. The most important of these was the strike of 120 machinists, involving five firms, at St. John, N.B. This strike commenced on January 27. The men demanded a minimum of 68 cents per hour and an eight-hour day, instead of the former minimum of 50 cents per hour and a nine-hour day. Later developments of this dispute would seem to indicate that the principle of union recognition was also a factor. This group closed for the month with eight disputes unterminated, involving 943 employees and an approximate time loss of 21,202 working days.

TENDERS

The city of Montreal wants tenders for the manufacture, delivery, and erection of two 30,000,000-gallon motor-driven pumps, tenders to be mailed not later than March 15, 1920. Specifications and information can be obtained from the Director of Public Works, City Hall, Montreal, P.Q.

The Department of Public Highways will receive tenders up to March 17 for the supply of from one to five horse-drawn steel gasoline tanks, capacity about 400 gallons for storing and moving gasoline. Prices f.o.b. factory. Tender envelopes can be obtained at the office of the Department, Toronto.

The Department of Public Highways require tenders for wagon loaders, tenders to be in by March 24, 1920. They are to be gasoline-driven mechanical waggon loaders, one f.o.b. Beamsville, and one f.o.b. Cainsville, delivery not later than May 17, 1920. Specifications can be obtained at the office of the Department of Public Works, Toronto.

The Department of Public Works of the Province of British Columbia is calling for tenders for the construction of a highway bridge over the Columbia River, Brisco. Tenders must be delivered by March 13, 1920, and plans and specifications can be obtained at the Public Works Dept., Victoria; District Engineers' Office, Vancouver; or the District Engineer's Office, Golden, B.C.

STATUS OF ELECTRIC FURNACE

(Continued from page 273)

verted into iron (Fe) at 700° C., and the reaction becomes more rapid with increasing temperature until a temperature of 800° C. is reached when it is complete, all the iron being in a spongy metallic state. The sponge iron is all melted when temperatures of 1100° to 1300° C. are reached, there being some variation in the heat required according to the analysis of the iron.

Efforts have been made to utilize iron sponge in various types of processes, and heretofore the main difficulty has been the prevention of re-oxidation when the highly-heated sponge comes into contact with the air. In the process at present being considered the arrangement of the reducing furnace and the electric furnace in which the melting down takes place is such that this difficulty is obviated.

This process is particularly adapted to the production of iron or steel direct from many of the Canadian ores which at the present time are not usable in their raw state and which have to undergo some treatment such as sintering before being in a suitable condition for the blast furnace.

INTERESTING CATALOGUE

The Lakewood Engineering Co., Cleveland, Ohio, have issued a very interesting catalogue dealing with their Tier-Lift Truck. The action is explained and various comprehensive photographs are given, showing the truck in action. Various transportation problems are discussed, and the solutions to them shown. Anyone requiring a truck of this nature will be interested in this catalogue.

—Morris for George Matthew Adams Service
Uncle Sam: "See who's coming to keep house for us."

WELDING OF LOCOMOTIVE CYLINDERS

By L. A. North

The welding of locomotive cylinders and other parts has been made possible and very successful by the introduction of oxy-acetylene and electric welding. It has been possible to weld locomotive cylinders which formerly would have been scrapped or repaired with either a brass patch or a dovetailed insert of some other metal, the weld in the majority of cases making a substantial and satisfactory job provided the expansion and contraction had been properly taken care of.

Experience has taught us that in order to properly weld a locomotive cylinder or a casting of any make or design, it is necessary to thoroughly pre-heat to insure a uniform temperature in order to properly take care of the contraction and expansion and to avoid cracking after the weld has been made and the metal has been allowed to cool off. The success of any weld of this kind depends largely on the care used in the pre-heating and the judgment of the operator making the weld. We cannot be too particular in the selection of the operator for this class of work.

Some difficult welds have come to my observation, one in particular, where the entire upper portion of the cylinder at the port area had been totally destroyed. This was repaired by having a grey iron patch cast in the foundry, fastened to the cylinder by means of clamps and welded in place. The cylinder was pre-heated to a uniform temperature to take care of the expansion and contraction. After the weld had been made and the cylinder had cooled down, a reinforcement was added to this weld by drilling through between the stud holes and securing the additional support by tap bolts which were tapped and screwed into the main barrel.

It is possible to weld broken bridges in slide valve cylinders successfully. Recently this was done and effected a saving of two cylinders in place of the one, which was cracked, as the cylinder which was repaired was an obsolete pattern, and had we not been able to make this weld the application of an entire pair of cylinders to this engine would have been necessary. As this engine was one that in a few years will be placed in the scrap pile, I am satisfied that the weld will outwear the present cylinders.

Not having experience with electric welding on cast iron, I am not prepared to enter into a discussion of this method to any great extent, but I have examined a number of castings which have been repaired with the electric welding process, and careful examination failed to disclose any flaw or fault in the weld.—"Welding Engineer."

THE REMOVAL OF PAINT FROM IRON AND STEEL SURFACES

By F. A. McLEAN.

Scraping or burning paint from the surface of iron and steel structures previous to the application of a new coat is a slow and laborious process. An easier and more rapid way of doing this work is the method used by the United States Coast Artillery, for cleaning the exterior portions of the big guns and gun carriages in their care.

In practice, a one pound can of concentrated lye is dissolved in three quarts of boiling water, and to this mixture sufficient lime is added to emulsify the solution. This solution is freshly mixed each time it is to be used and is applied with a brush and allowed to remain until it is almost dry. It is then removed and unless the paint is very old and thick it will come off with it. If one application of the mixture does not remove all of the paint, the surfaces are washed off and a second coating applied. Before a new coat of paint is put on, the surface of the metal should be thoroughly cleansed with a solution of washing soda (in the proportion of one-half pound to two gallons of hot water), and well dried either by wiping with soft cloths or by the application of heat.

The Lignite Utilization Board of Canada will receive tenders at its offices, 2 Youville Square, Montreal, for three horizontal return tubular boilers, 72 in. by 18 feet, 160 lbs. per square inch working pressure, to be built to the requirements of the Province of Saskatchewan, together with accessories and fronts. Specifications can be obtained from the Board at the above address.

TENDERS

The Bruce County Council are asking for tenders for a bridge over the Teeswater River on the Brant and Greenock Township line. One tender is for concrete abutments and pier and reinforced concrete span. Tender No. 2 is for 105 feet steel through truss. Plans and specifications can be seen at the office of the County Engineer, Mr. Fred B. James, Walkerton, Ont. The latest date for tenders to be received is March 15th.

The City of Niagara Falls, Ont., is asking for tenders, to be received up to March 15th, for a standard-built motor pump of 100 to 110 housepower, rotary pump of 600 gallons capacity, chemical tank 35 gallon capacity, Sewell cushion wheels, and standard equipment. Proposals to be addressed to the W. J. Seymour, City Clerk, and place where apparatus may be seen in action must be stated.

The Department of Public Highways will receive tenders up to March 23rd of the supply of from 25 to 40 tank car lots and 300 to 600 barrels of 50 per cent. asphaltic road oil prior to October 1st, 1920. Specifications and tender envelopes may be obtained at the office of the Department of Public Works and Highways, Toronto.

— Kirby in New York "World"

THE OUTSIDERS

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FOR SALE — THE FOLLOWING REBUILT Machine Tools, in condition nearly equal to new: 1—24x10-in. New Haven Engine Lathe, G. C. gears, 20-in. Universal chuck, $800.00. 1—Petrie heavy duty manufacturing lathe, $550.00. The A. Bernard Industrial Company, Fortierville, Quebec, Canada. (c12m)

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United States Patent 1306653 for Power Transmission Toothed eGaring.
United States Patent 1323120 for Cutting double helical teeth in Gear Wheels.
United States Patent 1325459 for Improvements in Thrust or Collar Bearings.
Pending Application U.S. Serial No. 248639 for Power Transmission Toothed Gearing.
Canadian Patent 161863 for Gearing.
Canadian Patent 1920099 for Cutting double helical teeth in Gear Wheels.
Canadian Patent 194629 for Power Transmission Toothed Gearing.
Pending Application Serial No. 225125 for Power Transmission Toothed Gearing.
Pending Application Serial No. 226126 for Improvements in Thrust or Collar Bearings.

The Company is desirous of entering into negotiations either for the sale of the patents outright or for their exploition by grant of licenses and would be glad to receive enquiries in respect thereof.

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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Vol. XXIII., No. 12. March 18, 1920

Die Castings, Their Various Uses and Advantages

The Fisher Motor Co., Orillia, Ont., Who Are Now Producing Die-Castings in Canada, Comment on Several Interesting Points in Connection With This Labor-Saving Industry

By J. H. MOORE.

IT IS a recognized fact that the manufacturing problems of Canada have changed greatly within the last decade. The need of rapid production has built up huge organizations capable of quantity production, where before, manufacturing was limited by the methods employed. Canada is at the present time looking forward to a future that will mean still greater manufacturing achievement, and that will bring to their various manufacturers a keener interest in everything that tends toward increased efficiency.

Among the many methods developed within the past twenty-five years, with a view toward improving large scale production, the process of die casting has been widely accepted as a means of eliminating machining, and as such has gained steadily in favor.

To the uninitiated, we might state that die casting is performed by forcing molten metal into steel moulds under such pressure that, after solidifying, its surfaces conform so minutely to the interior of the steel mould as to yield practically finished results. As a matter of fact, there is absolutely no variation between two die castings out of the same mould or die, while between duplicate pieces machined by one and the same workman, there is always a chance of error.

Die castings have long since ceased to be an unknown quantity. They have taken their recognized place with such parts as stampings, screw machine parts, forgings, etc.

Take for instance such well-known products as automobile accessories, phonograph parts, electrical instruments, adding and billing machines, milking machines, aeroplanes, cream separators, motor boat parts, stationary engine parts, photographic supplies, etc. All these lines lend themselves readily to die-casting production, in fact there are few lines of manufacture which have not found some use for die castings.

A SMALL SECTION OF THE DIE-MAKING DEPARTMENT.

So far the majority of Canada's requirements in the die casting field have been filled by other countries, principally the United States, but now Canada has awakened to its opportunities in this regard and we can look forward to their going after their own home business.

The Fisher Motor Co., Orillia, Ont., realizing the possibilities of this field, have gone into the business in earnest, and have not only reached the production stage but are already shipping their product.

Before going into a description of their plant, however, let us delve into a short history of the advance of the die casting industry. In the year 1900 an exhibition of die castings received recognition at the Paris Exposition, but even as far back as 1892 their advantages had been recognized by various manufacturers. The castings made in those earlier days were mostly small, from low fusing alloys, but with the growth of the automobile industry came a marked advancement in the production of die castings.

It seemed as if at last die castings had established their real worth. Not only were they found ideal for engine bearings but were found invaluable for the framework of magnetos, for lighting systems, oil, water and air pumps, engine governors, and many other accessories.

The addition of aluminum to the other alloys previously used made the die casting process especially valuable in the production of small parts for aeroplanes, telescopes, binoculars, gas masks, bombs, and other devices where lightness was required.

The standard die castings, that is those made from the regular die casting alloys, found their field in such articles as truck governors, bearings for tractors, and so on. We could go on indefinitely, mentioning the various industrial fields which have benefited by the use of die castings, but let us next take up the metals commonly used for this type of casting.

The Metals Used

In the early development of the die-casting business, a great many alloys were experimented with, so that naturally the variety of alloys used at that time was very great. With the advance and development of the industry, however, it was found that a relatively small number of alloys would meet the requirements of the trade.

Briefly, the metals used in die casting can be divided into five groups as follows: The white metal, the tin base, the aluminum base, the brass and bronze base, and the lead base.

The white metal group comprises the zinc base alloys. The metals in this

"We intend to show Canadian manufacturers that we can make first-class die castings in Canada," says Mr. Vollans—and we believe him.

group contain a certain percentage of zinc, tin and copper. The zinc base alloys are perhaps more easily handled in the die casting process than any of the other alloys, and are therefore more generally used. They can be employed for all purposes where cast iron or yellow brasses can be used. The tensile strength of such an alloy is less than that of the brasses, so that in this grouping, castings of such alloy should only be used when the tensile strength required does not exceed 17,000 to 20,000 pounds per square inch. This strength, however, is obtainable when the metal is properly treated during the process of alloying of casting.

SOME INTERESTING EXAMPLES OF DIE-CASTINGS.

Zinc base castings present about the same wearing surface as cast iron or yellow brass. Castings of this alloy are used to quite an extent on small electric motor frames, magnetos, and on many parts in the automotive and electrical fields. Generally speaking, the characteristics of zinc-base alloy castings are similar to those of cast iron. Some concerns used about 86 per cent. zinc, 7 to 10 per cent. tin, and from 4 to 7 per cent. copper. In some cases, other metals are added to obtain certain results depending on the nature of the casting, and what it is to be used for.

The Tin Base Alloy

The tin base alloys are used principally for bearings, and are, in reality, what is more generally known as babbitt metal. Of course, it is well-known that this class of metal varies considerably in composition, some even containing as high as 85 or 90 per cent. of tin, while the cheaper metals contain a much smaller percentage.

This alloy is also used for parts which must resist acids, such as parts of milking machines, and other parts used in the food industries. Again, the alloy's composition depends upon the requirements. To make the metal extremely acid proof, the tin is kept high in percentage, the antimony next, and the copper last. For example, a favored mixture or composition is made of 90 per cent. tin, 6 per cent. antimony, and

A FEW EXAMPLES OF DIE CASTINGS.

4 per cent. copper. The addition of the antimony and copper increases the hardness of the alloy.

The Aluminum Alloys

While it is possible to die-cast pure aluminum, there is no value in so doing because aluminum in its pure state is too soft for commercial use. For this reason, the standard aluminum alloys contain a high percentage of aluminum alloyed with copper. This is the arrangement generally adopted when a light casting of considerable strength is required. A commonly used mixture is 92 per cent. aluminum and 8 per cent. copper. This alloy, when produced in die casting form, has a tensile strength of approximately 20,000 lbs. per square inch and is employed whenever a light, strong alloy is required. Before die casting, the alloy is really 25 per cent. less efficient than after completion.

A GROUP OF DIE-CASTINGS, SHOWING THE VARIETY OF WORK OBTAINABLE BY DIE-CASTING PROCESS.

ILLUSTRATING THE EXTENT TO WHICH DIE-CASTINGS CAN BE USED. NOTE THAT EVERY PIECE ON THIS ENTIRE GRINDER IS MADE FROM A DIE-CASTING.

Another alloy often used on automobile parts contains a high percentage of aluminum as before, but also from 2 to 5 per cent. of magnesium, and from 3 to 7 per cent. copper. This alloy is much stronger than the former mixture given, and by proper treatment in melting and casting it is possible to obtain a tensile strength as high as 35,000 pounds per square inch.

The copper hardens the metal as before, while the magnesium produces a closer grain than can be obtained in the first given alloy. Nickel is sometimes added to produce still greater hardness.

Where gears are not subjected to heavy wear or strain, but merely transmit motion without a great deal of power, die castings can be used to a nicety. Accuracy is easily obtainable, and the saving effected in the elimination of the necessity of teeth cutting is a big factor. Spur and bevel gears are the usual type cast, although spiral and worm gears can be cast if desired.

As white metal castings are cheaper and easier to make, they are therefore used whenever there is no need for an exceptionally strong metal. Aluminum alloy castings are, of course, used when strength and lightness have to be combined.

It might be well to mention at this point that complicated shapes have no terror for the die-casting process. Shapes almost impossible by any other process can be perfectly and accurately formed. The various illustrations accompanying this article will, no doubt, convince the most skeptical.

Brass and Bronze Alloy

The casting of brass and bronze alloys are also possible. Practically the same shapes can be produced in brass as are produced from other alloys with the exception that very small holes cannot be cored and produced directly in the casting as in the other alloys, but must usually be drilled afterward.

The reason for this is that the pins of small diameter which are necessary to produce these holes, show a slight tendency to warp when subjected to the high temperatures necessary when keeping brass or bronze in a molten condition. This small objection is, however, overbalanced by the advantages derived from the die-casting process.

Points to be Remembered

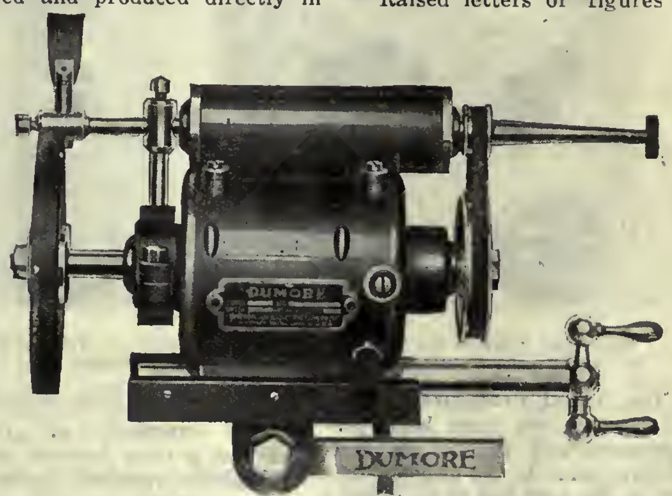
When planning to use die-cast parts, there are certain general points, which, if borne in mind, will increase results in service obtained.

In dealing with steel cores, necessary in a process producing finished parts, undercuts or recesses in the interior wall of the casting should be avoided as much as possible. In many cases, it is possible to use collapsible or sand cores, but this increases the cost of both dies and castings.

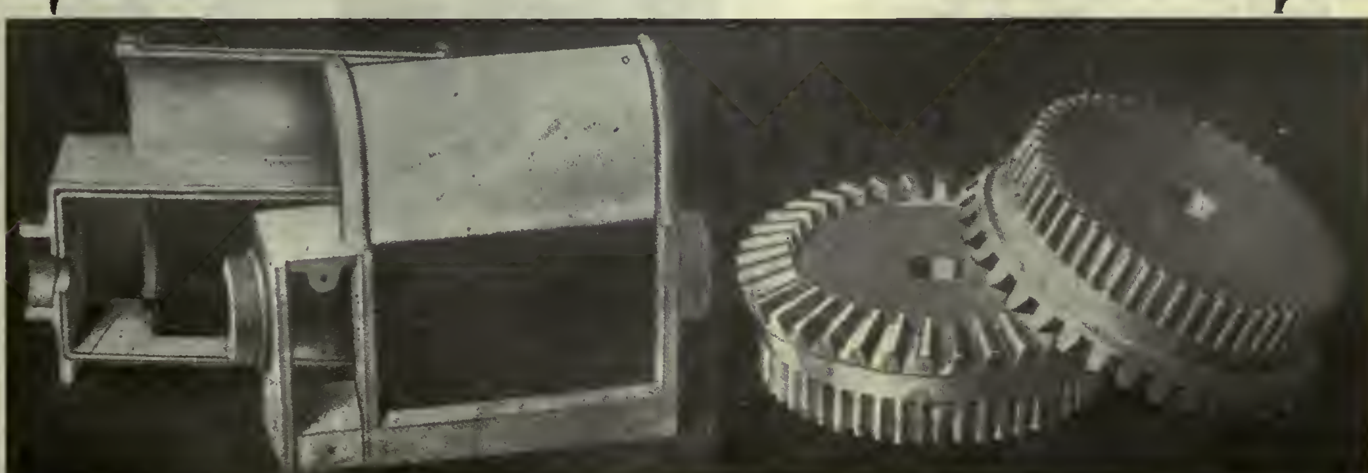
If at all possible a slight draft is desirable, but this is not absolutely necessary. No allowance for shrinkage or machinery need be made in drawings except where excessive accuracy is required, or where a machining operation is actually necessary to true up a piece for assembling purposes.

Raised letters or figures are easier made and cheaper to cast, although both the raised and depressed figures are practical and often used.

If at all possible, allow small fillets at sharp corners, for these add strength to the casting, and increase the rate of production. Where zinc or aluminum base metals are used, the walls of the castings should be at least 1-16 inch to 1-8 inch of an inch thick, according to the size of the part, but when softer



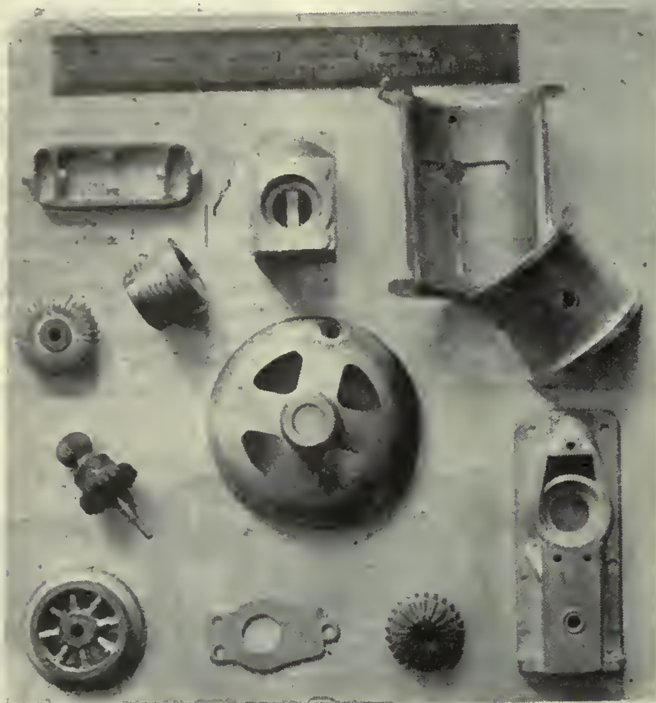
THIS ILLUSTRATES A WELL KNOWN GRINDER WHOSE PARTS, AS SHOWN ABOVE, ARE MADE FROM DIE CASTINGS.



DIE-CASTINGS ARE IDEAL FOR SUCH WORK AS SHOWN IN THIS PHOTOGRAPH.

metals are used these walls can be made still thinner if necessary.

Castings made by the die-cast process can be held to the accuracy of one-thousandth of an inch, which is an advantage not to be overlooked.



ANOTHER GROUP OF INTERESTING DIE-CASTINGS. THE SCALE SHOWN WILL GIVE AN IDEA OF PROPORTION.

The Actual Procedure

Let us suppose we have been producing some certain product in cast-iron, and have come to the decision that from now on the part has to be made a die casting. What is the proper procedure?

First and foremost in the decided change enters the cost of the die. This unfortunately has held back many a concern who cannot, or will not look further than the die cost. To make any change in plans costs money, but if by expanding a certain amount of cash you save money and increase production, you are further ahead in the long run.

Manufacturing conditions in Canada have now reached such a point that luckily the various firms are looking ahead of this first cost. After the die is completed, the rest is easy. Suppose we next consider the plant itself.

The Fisher Motor Co. are well-equipped to handle this die-casting proposition. Mr. Vollans, the president and general manager of the concern, is himself taking an active part in the business. There is hardly an automobile or machine tool plant where Mr. Vollan's accomplishments are not already known, so we need go no further on this point. He has with him experts in both the die-casting and tool-room practice, for as can be understood, the skilled labor employed belongs to these two classes.

We would like to impress readers with the accuracy necessary on the die work, for even if five-thousandths were allowed between these dies, the metal forced up into them would squeeze out, causing an objectionable fin.

When the die is completed it is placed in a special die casting machine of their own design. When everything is in closed, or die casting position, the molten metal is forced up into the die at a pressure varying from 200 to 1,200 lbs., depending upon requirements.

The number of castings die-cast at a time depends entirely on the production required yearly, and the intricacy of the die. It is easily understood that if a concern requires 50.000 pieces yearly, it can well afford to spend money on a multiple die.

After the castings have been die-cast, they go to the first inspection department, where they are carefully looked over for possible flaws, such as blow holes, cracks, etc. Providing they are satisfactory they proceed to the cleaning department, where all fins or gates are removed. They next go through a final inspection before shipping, in order to insure that only perfect castings leave the plant. In this final inspection, the sizes of the castings are also checked.

Analysis of the Metals

The melting of the metals used in die-casting work is a study in itself. Of course, the various metals are bought in their commercial form by the company, and are melted and alloyed to suit the different requirements. The chemical department takes a careful analysis of every alloy made, and reports on its different qualities. All raw materials received are also analyzed in order to make sure that the proper metals are being used.

Although the die-casting art is a comparatively new industry to Canada, we can safely look forward to seeing it grow to large proportions, for die-castings are now a recognized necessity and not merely a novelty.

There is a constant development taking place in this industry, and work formerly thought impractical has been successfully accomplished. This advancement is bound to continue and the next few years will, no doubt, further emphasize the advantage of the die-casting process for certain classes of work. As Mr. Vollans remarked to the writer, "We intend showing the trade that we are out to make die-castings of only first-class quality, and we also hope to educate the different manufacturers as to where die-castings are possible in place of other metals at present used."

IT IS NOT GENERALLY KNOWN THAT THE MAJORITY OF PHONOGRAPH TONE ARMS AND SMALL PARTS, ARE MADE FROM DIE-CASTINGS. HERE ARE SOME GOOD EXAMPLES.

With this we will leave the subject, keeping our eyes open for future developments which are sure to occur

The Helical Gear, Its Design and Application

The Final Portion of a Treatise Covering the Application of Helical or Twisted Teeth to Gears Operating on Parallel Axis, Together With Data on Design, Application and Production

INVESTIGATIONS made to determine the strength of helical gear teeth have never been conclusive. Of course, this is easy to see when we consider the number of variable factors that enter into the problem. It is therefore impossible to give any rule or formula for calculating the strength of helical gear teeth which can be universally followed. The conditions that arise in each case must be considered separately, and all of these conditions are seldom known, so that any rule or formula must be considered approximate only. In the following an attempt will therefore be made to analyze some of the most important points that must be considered in determining the strength of helical gear teeth.

Comparison of Tooth Action of Spur and Helical Gears

An investigation of the tooth action of the helical gear reveals the fact that a helical tooth must be considerably stronger than a spur tooth of the same pitch, pressure angle, etc., for the reason that there is always a greater number of teeth in action and the tooth action is different. The diagram, Fig. 5, should illustrate this clearly. Another reason is that the greatest load is always taken somewhere in the vicinity of the pitch line.

An analysis of the action of the spur gear tooth shows that there are three distinct phases of engagement; first, as at A, Fig. 8, the point of one tooth engages with the flank of its mate; second, as at B, the teeth are in engagement in the vicinity of the pitch line; and third, as at C, the flank of one tooth is in engagement with the point of its mate.

The greatest load on the spur gear tooth is therefore exerted when the teeth are in engagement in the first and third positions. As the pinion tooth is always weaker than the gear tooth (the same materials being considered), it is therefore evident that with the gears operating in the direction indicated in Fig. 8, the weakest point on the pinion tooth can be determined as indicated at A, according to the Lewis formula.

It is also evident that when the teeth are in engagement at the pitch line, they are more capable of carrying the load, and in this connection it is also interesting to note that the teeth roll on the pitch line, where at all other points of their action they slip upon each other.

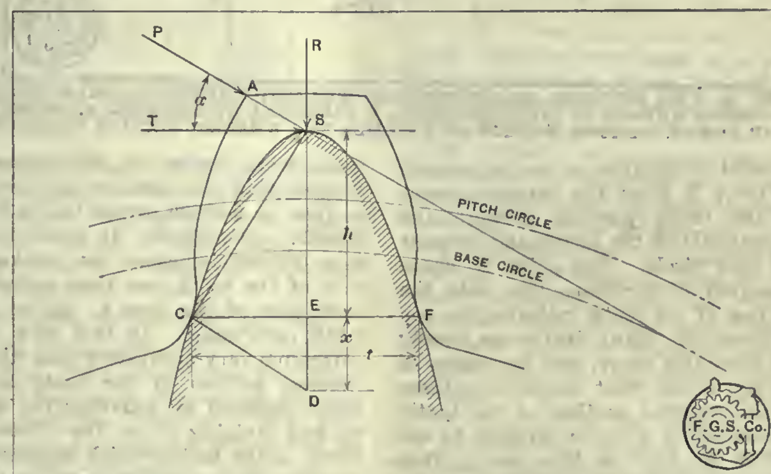


FIG. 8.—DIAGRAM SHOWING PROGRESSION OF CONTACT ON SPUR GEAR TEETH.

Members that are in rolling contact will carry a much heavier load, generally speaking, than those under two loads; viz., pressure and friction. This is especially true of gear teeth.

Method of Determining Location of Weakest Section

The method of determining the location of the weakest section of a helical gear tooth, is found in a slightly different manner from that of a regular spur gear tooth. In a spur gear, for instance, the line of pressure passes through the point of the tooth, as is shown in the diagram, Fig. 9. Owing to the overlapping of the tooth action of the helical gear tooth, the pressure line P crosses the axis of the tooth in the vicinity of the pitch line. In the spur gear the strength of the pinion is not governed by the number of teeth that is in mesh with it, whereas, the strength of the tooth of a helical pinion is governed directly by the number of teeth of the gear in mesh with it.

To determine the location of the point on the axis of the tooth through which the pressure line passes, it is necessary to construct a diagram. With a little experience it is not even necessary to lay out the teeth, but simply draw a series of circles representing the outside, pitch and base circle diameters of the pinion and gear, respectively. The line of action is then drawn tangent to both base circle diameters, and of course, both pitch circles should be tangent to each other. The base circle diameter is found by multiplying the pitch diameter by the cosine of the pressure angle.

We can now determine the strength of a helical gear tooth in the same manner as a spur gear tooth. After an outline of the tooth has been drawn on the normal plane, described later, a line is drawn tangent to the base circle, and passing through the point found in the following manner:

Where the outside diameter circle of the gear cuts the line of action is the point where contact starts on the pinion tooth. The location of the point on the axis through which the pressure line passes will then be one half the distance from this point and the outside diameter of the pinion.

Diagrammatical Method of Determining Weakest Section of Tooth

In order to determine the weakest section of the tooth, it is necessary to construct a parabola passing through the point of application B of the tangential force and tangent to the tooth profile at C which is assumed to be the weakest section. The parabola thus constructed encloses a cantilever beam of uniform strength, the weakest section of which lies in the plane CEF of the base of the parabola. The problem is to find the location of the base of the parabola.

The first step in determining the weakest section of the tooth, assuming that the tooth outline has already been

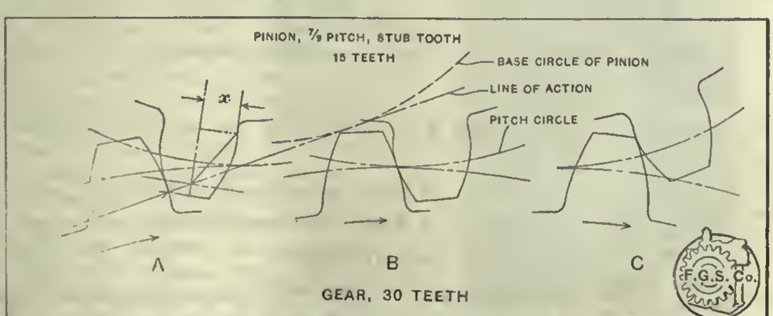


FIG. 9—DIAGRAM ILLUSTRATING GRAPHICAL METHOD OF DERIVATION OF THE LEWIS FORMULA FOR STRENGTH OF GEAR TEETH.

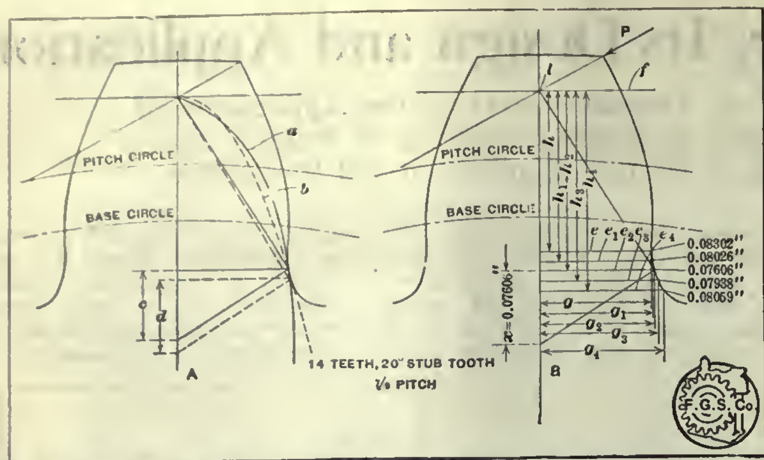


FIG. 10—TWO METHODS OF DETERMINING WEAKEST SECTION OF GEAR TOOTH. A SHOWS METHOD OF CONSTRUCTIONG A PARABOLA BY DRAWING AN IRREGULAR CURVE. B SHOWS METHOD OF CALCULATING WEAKEST SECTION OF TOOTH.

constructed, is to draw a line represented by force P from the extreme point A of the tooth passing through the centre line RD of the latter and tangent to the base circle. The point B where this tangent or pressure line cuts the centre line of the tooth indicates the top of the parabola. Many draftsmen simply use an irregular curve, and by means of their eye, locate what appears to them to be the weakest section of the tooth. Then they draw a curve tangent to the profile of the tooth at this point. That this is an extremely rough and inaccurate method is clearly illustrated at A, Fig. 10. Here two irregular curves a and b have been drawn tangent to what appears to be the weakest section of the tooth, but we find that distance c does not equal the distance d; therefore, the "sight" method is not an accurate one.

Mathematical Method of Determining Weakest Section of Tooth

This method is illustrated diagrammatically at B in Fig. 10. In its primary steps it does not differ from that shown at A, up to the point where the weakest section of the tooth is to be determined. After constructing the tooth section (which should be drawn to an enlarged scale, preferably 10 to 1), draw a series of parallel lines, e, e_1, e_2, etc., 0.100 inch apart, and at right angles to the vertical centre line of the tooth; then draw a parallel line f passing through the intersection point of the pressure line P and the centre line of the tooth. We now, by trial calculations, determine the weakest section of the tooth.

To proceed, we measure the length of the line e, which is the distance g; we then square this distance g and divide it by the distance h, and this gives us the factor as shown in the illustration. For example, $g = 0.1188$ inch, and $h = 0.17$. $0.1188^2 \div 0.17 = 0.08302$ inch. We proceed in this manner, starting well above what appears to be the weakest section and continue until the values obtained reduce and then start to increase again. The smallest value indicates the weakest section of the tooth. At B in Fig. 10, the tooth profile appears as five times actual size, but the result of the calculations are given as though the teeth were drawn to the actual size. We see that the distance g_2^2 divided by h_2 gives us 0.07606, which lies in between 0.08026 and 0.07938. In order to prove that 0.07606 indicates the weakest section of the tooth, we thus calculate on each side of the line e_2, taking spaces 0.010 inch apart. In this way we can determine very accurately just where the weakest section of the tooth is. The value obtained by squaring the distance g_2, and dividing it by the distance h_2, gives us the factor which represents the weakest section and is equal to the value x. We therefore find x by calculation instead of directly by measurement.

The helix angle of the helical gear, as will be explained later, affects this strength factor obtained by calculation. As the helix angle is increased, a greater load is imposed on the tooth, so that its relative strength is less.

Determining Proportions of Tooth on Normal Section

The greatest load on a helical tooth is taken in a plane at right angles to the normal section of the tooth, so that in order to determine the strength of the tooth, we must find the proportions of the tooth on the normal plane. Fig. 11 gives us the information that we want in order to determine the shape of the tooth on the normal plane. In order to take a practical example, we will assume the following: To determine the strength of a 15-tooth pinion, 7/9 pitch, 20-degree stub, 23 degrees 25 minutes pressure angle, the proportions of the tooth on the diametral plane are shown on table below:

We see from Fig. 11 that on normal plane, the gear is of elliptical shape, but in order to determine the strength of the tooth we ignore this eclipse and consider the tooth simply as though it were laid out with a larger pitch diameter, greater number of teeth and smaller pressure angle.

How a Steep Helix Angle Affects Gear Tooth Strength

The disadvantages of a steep helix angle for a helical gear are three in number. First, a steep helix angle increases the end thrust; second, it increases the tangential load on the tooth, and, third, it reduces the cross-section of the tooth on the normal plane, mak-

Diametral Plane

Number of Teeth	15
Diametral Pitch	7/9
Pitch Diameter, inches	2.1428
Pressure Angle	20°
Tooth Thickness, inches	0.2244

Normal Plane

$$\text{Number of Teeth, } N_1 = \frac{N}{\cos.^3\ a} = \frac{15}{0.7727} = 19.4125$$

$$\text{Diametral Pitch, } P_1 = \frac{P}{\cos.\ a} = \frac{7}{0.91764} = \frac{7.6283}{9}$$

$$\text{Pitch Diameter, } D_1 = \frac{N_1}{P_1} = \frac{19.4125}{7.6283} = 2.5448 \text{ inches}$$

$$\text{Tooth Thickness, } T_1 = \frac{1.5708}{P_1} = 0.2059 \text{ inch}$$

$$\text{Tan. of Pressure Angle } \beta = \tan.\ 20^\circ \times \cos.\ 23^\circ\ 25' = 18^\circ\ 28'$$

In which:

N = number of teeth on diametral plane
N_1 = number of teeth on normal plane
P_1 = normal diametral pitch
D_1 = normal pitch diameter
T_1 = normal tooth thickness
β = normal pressure angle

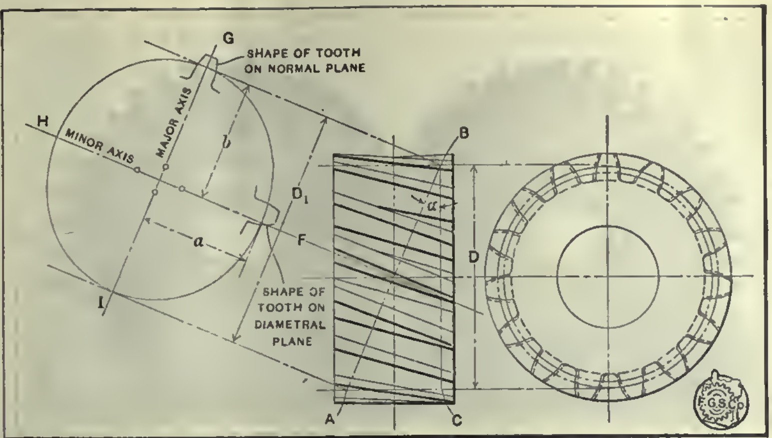


FIG. 11—DIAGRAM SHOWING DERIVATION OF FORMULAS FOR OBTAINING THE NUMBER OF TEETH ON NORMAL PLANE, AND OTHER NORMAL TOOTH ELEMENTS OF HELICAL GEARS.

ing it less capable of carrying the increased load.

In order to show how a steep helix angle affects the strength of a helical gear tooth, we will take several examples. In the first case, we will compare a 15-tooth spur pinion, 7/9 pitch, with a helical gear of the same pitch and having a helix angle of 15 degrees and 12 minutes. According to the Lewis formula, the strength factor x, for a spur gear of this pitch is 0.0794, and a helical gear of the same pitch and having a helix angle of 15 degrees 12 minutes is 0.1024. A helical gear tooth of 15 degrees 12 minutes helix angle is therefore approximately 29 per cent. greater in strength (ignoring the added strength resulting from the greater face width due to the angularity of a line of contact) than a spur tooth of the same pitch; but we have the factor of increased tangential load to consider. The actual load on the 15-degree 12-minute helical gear is approximately 3½ per cent. greater than that on the spur gear, thus reducing our increased strength factor down to about 25½ per cent. Therefore, we can consider that a helical tooth having 15-degree 12-minute helix angle has approximately 25 per cent. greater effective strength than a spur gear of the same pitch, etc. When we increase the helix angle, however, we find that we weaken the tooth from two standpoints. First, we increase the tangential load on the tooth; and second, we reduce its cross-section on the normal plane. A comparison of a 15-tooth spur pinion with a helical pinion of the same number of teeth and having a helix angle of 23 degrees 25 minutes gives us the following results: From the standpoint of increased tooth strength a helical gear of 23 degrees 25 minutes helix angle is approximately 17 per cent. greater than a spur pinion of the same number of teeth; but when we take the increased load into consideration we find that this increase in the helix angle imposes a tangential load on the tooth which is approximately 8¾ per cent. greater than that imposed on a spur tooth, so that this reduces our effective strength to approximately 8½ per cent. If we carried on our calculations still further, assuming a still greater helix angle, for instance 45 degrees, we would find that our helical gear instead of being stronger than our spur gear was actually about 50 per cent. weaker. This factor would be lowered, however, when we took the angularity of contact factor into consideration.

Substituting Helical for Spur Gears

We are frequently asked by manufacturers for information regarding what we would suggest in the way of a helical gear to take the place of a spur gear where extreme quietness of action is desirable. This frequently comes up, especially in connection with cam-shaft drives for automobile engines. As a general rule, it is necessary for the same centre distance to be retained and also the same ratio between the two or more gears used; so that the problem is one that requires the selection of a set of helical gears having the same centre distance as spur gears and to be of the same tooth ratio.

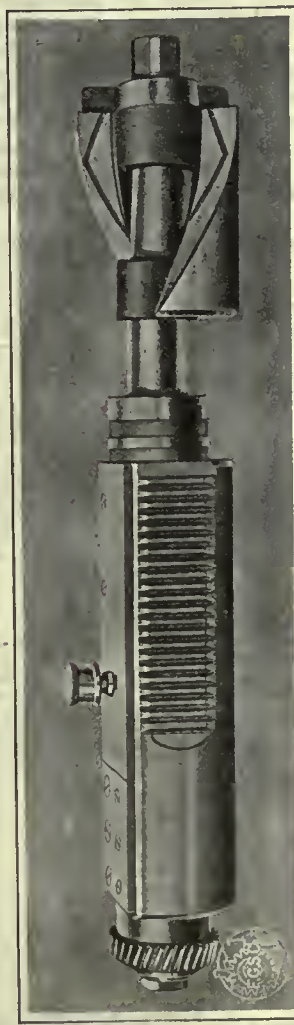


FIG. 13—HELICAL GUIDE AND CUTTER WITH CUTTER-SLIDE ASSEMBLED: USED ON THE FELLOWS HELICAL GEAR SHAPER.

The Question of Enlarged Pinions

The Involute Curve possesses the advantage of flexibility as regards centre distance and pitch diameter. This flexibility of the involute enables us, therefore, when changing over from spur to helical, to enlarge or reduce the diameters of the gears so as to retain the required centre distance and tooth ratio.

The problem of changing over from spur to helical is sometimes a difficult one, depending largely upon the requirements that have to be met. It is, therefore, impossible for us in this limited space to thoroughly explain all of the points connected with this problem. What we will endeavor to do, however, is to take a simple example which will explain some of the most important points.

We will assume, for example, that we have a pinion of 15 teeth and a gear of 60 teeth, 14½ degree pressure angle, 6 pitch, which is to be replaced by helical gearing. Now, our first consideration is to select an approximate helical angle for our helical gears. Let us assume that these gears are to drive the cam-shaft of an automobile engine, and that the helix angle of 23 degrees will be about right. We will also substitute stub teeth of 20 degrees pressure angle for the 14½-degree full-length teeth.

Calculations for strength show us that 6/8, 7/9 and 8/10 pitch stub-teeth spur gears are all stronger than 6 pitch full-length 14½-degree gears. We therefore have at least 3 pitches to select from.

For the sake of comparison, we will try 8/10 pitch and see what result we get; taking 20 teeth for the pinion and 80 teeth for the gear, we get a tooth ratio of 4 to 1, and a centre distance equal to 6.250 which is exactly what we want. As an 8/10 pitch helical gear having 23-degree helical teeth is stronger than 6 pitch 14½-degree teeth, we can use 8/10 pitch for our gears, should we so desire.

Cutting Helical Gears

The cutting of helical gears does not differ materially from the cutting of ordinary spur gears. There are a few points, however, in connection with the setting of the helical cutter relative to the work which differ from the spur cutter. Before proceeding, however, with a description of some of these points, we will deal briefly with the principle upon which the helical gear shaper operates.

Principle of the Helical Gear Shaper

The principle upon which the helical gear shaper operates has been previously explained. It differs from the principle upon which all other gear-cutting machines operate, in that the control of the helix angle is positive, and the cutter itself is a helical gear. This cutter works on the moulding-generating process and in its action on the work is similar to that of two gears in mesh.

Control of the Cutter

The helical gear shaper cutter, which is illustrated in Fig. 12, where both right- and left-hand cutters are shown, is simply a helical gear with the top cutting faces of the teeth ground at right angles to the helix angle of the tooth itself. In operation this cutter is held on the cutter-spindle, as illustrated in Fig. 13. The cutter is controlled in its operation on the work by means of helical guides. One of these guides is fastened directly to the cutter-spindle, and the other is retained in the upper worm wheel housing. An adjustable shoe is provided for taking up wear. The bearing surface, however, between these two guides is so great that wear is practically negligible.

This principle, it will be seen, differs from that employed on all other gear-cutting machines in that the change gears have nothing to do with the generating action of the cutter or with its control. All the change gears are for is to preserve the correct relation between the number of teeth in the cutter and the number of teeth in the work. The control of the cutter when in action on the work is positive and is not flexible, consequently the helix angle can be duplicated at any time. Furthermore, the helix angle is beyond the control of the operator, it is impossible for him to make a mistake in setting the machine as far as the helix angle of the gear is concerned.

FIG. 14—RIGHT- AND LEFT-HAND HELICAL GEARS SHOWING DIRECTION OF TWIST.

Another very important feature of the helical gear shaper is that the cutter itself is ground all over after hardening, including the involute curves on the teeth, which are generated by a precision grinding process.

Points on Cutting Helical Gears

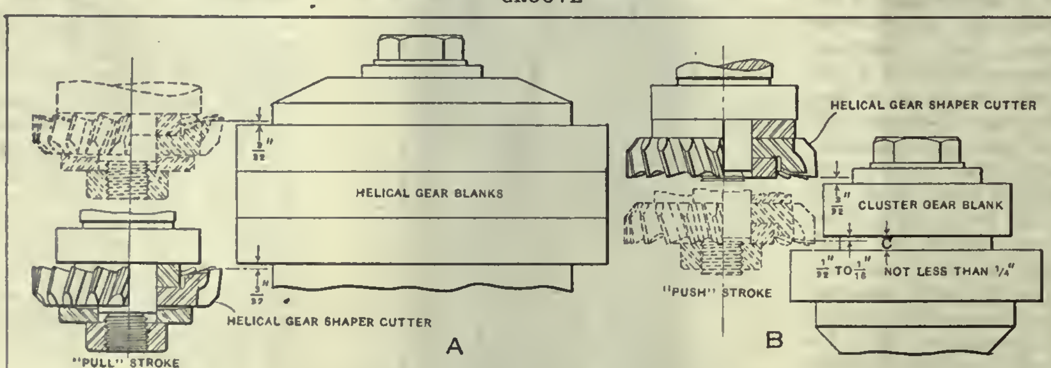
One point in connection with the cutting of helical gears, which will be mentioned, is that the helical cutter requires slightly more overtravel than the spur cutter, because of the relation of the top faces of the cutter teeth to the work. The amount of overtravel for various pitches and helix angles is given in Table III, where a diagram is also given showing the relation of the cutter to the work. The graduations or markings, therefore, on the crank-shaft head, which are used for setting the spur cutter and give an excess over-travel of 3-16th inch, cannot be used directly for the helical cutter; so that it is necessary for the operator to allow additional travel as illustrated in Table III, in order that the top face of the cutter will clear both the lower and upper faces of the work.

In the cutting of shoulder or internal gears in which a recess must be provided for the cutter to run into, it is necessary to have this recess slightly greater in width than that which would be satisfactory for spur cutters. The minimum width of the recess for shoulder or cluster gears is given in Table III for the various pitches and helix angles.

Marking of the Helical Cutter

In order to prevent any possible confusion with regard to the use of the proper cutter for cutting right-hand or left-hand helical gears, the helical gear shaper cutters are plainly marked on

TABLE III.—EXCESS AMOUNT OF OVERTRAVEL NECESSARY WHEN CUTTING HELICAL GEARS, AND MINIMUM WIDTH OF CLEARANCE GROOVE



Pitch	Helix Angle	Plain Helical Gears A	Helical Shoulder and Internal Gears B	
		Excess Amount of Overtravel — Inches	Excess Amount of Overtravel — Inches	Minimum Width of Groove C — Inches
5/7	15°–20′	7/64	5/64	5/16
5/7	23°–35′	5/32	1/8	23/64
6/8	14°–55′	3/32	1/16	19/64
6/8	23°	1/8	3/32	21/64
7/9	15°–12′	5/64	1/16	9/32
7/9	23°–25′	7/64	3/32	5/16
8/10	14°–55′	3/32	1/16	17/64
8/10	23°	3/32	1/16	19/64
9/11	15°–9′	1/16	1/32	17/64
9/11	23°–20′	5/64	1/16	9/32
10/12	14°–55′	1/16	1/32	1/4
10/12	23°	5/64	1/16	17/64
12/14	14°–55′	3/64	1/64	1/4
12/14	23°	1/16	1/32	17/64

the back face. For instance, the cutter which in reality is a left-hand cutter is marked "right-hand" it is to be used for cutting right-hand gears; and the cutter used for cutting left-hand gears is marked "left-hand," although in reality the twist of the teeth of the cutter is in a right-hand direction. Fig. 14 shows what is meant by right-hand and left-hand gears. A is a left-hand gear and B is a right-hand gear. It will also be noticed that the twist of the teeth on A travels in a left-hand direction, whereas the twist of the teeth on the right-hand gear travels in a right-hand direction.

Setting the Cutter to the Work

The helical cutter can be set with remarked "right-hand" as it is to be used in the same manner as the spur cutter, by using the 0.019-inch feeler gauge. Owing to the twist of the teeth it is necessary to use slightly more care in setting the helical cutter, and the cutter should be rotated by the crank-handle so that one of the teeth used for the setting be brought in an axial position relative to the work. The gauge also should be used at the top edge of the cutter, and it is advisable to rotate the cutter around a few times and make various tests to see that the correct setting has been obtained before starting the machine.

INTERESTING TYPE OF TAPER REAMER

By Robert Mawson

We recently had the problem of machining the lever shown in Fig. 1, which presented a difficulty which was solved as described.

The lever is made of a malleable iron casting and its general shape and size may be ascertained from the illustration.

The casting was first milled at the fork end and on the bosses A, using a pair of straddle milling cutters spaced to a distance of 5¼ inches on the inside cutting edges.

The next operation is machining the bosses B, and another set of straddle milling cutters is used for this work, the cutters being placed on the machine arbor, with the piece set on the milling machine table, so that the left-hand boss will be 1 inch away from the machined face of the left-hand fork boss, as shown.

The holes in the casting are next drilled and reamed, the holes being tapped in a later operation.

A jig was made for the work of drilling and reaming which was not very complicated, being of an open type.

The piece was located by headless screws placed at an angle of 45 deg., and were used at the fork end.

Screws and clamps being tightened onto the fork casting held it securely for the machining operation.

So far everything seemed to be coming smoothly and standard roughing and finishing taper reamers were tried to machine the large taper hole shown at C.

These reamers were guided through a bushing in the jig, but the results were very unsatisfactory.

The holes were scored and rough in their finish, and we did not seem able to retain the desired size, some holes being larger than would pass inspection even though a fixed stop was used, so that the reamer would enter the piece the same distance for all the forks being machined. It might be added that the hole was machined from the solid.

The problem was solved by using the reamers, shown in Figs. 2 and 3. A ⅞ in. hole was first machined, using a two-lip twist drill guided through a ⅞ in. bushing in the jig. A four-lip drill, 1.010 in. diameter, was then used.

The shank of this tool was 1 inch diameter, and was guided in a bushing of the jig of suitable size for the work. The roughing reamer, Fig. 2, was then used, and this was followed with the reamer, Fig. 3.

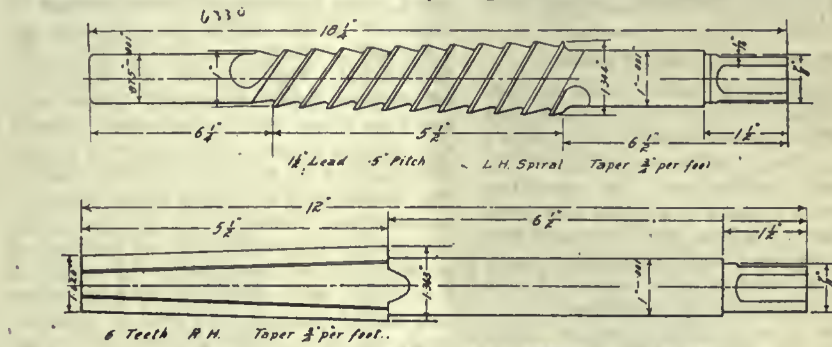
It will be noticed that the reamer, Fig. 2, is of unusual construction. It is made with angular cutting edges with a pitch of .500 in. and triple lead. The spiral is made left hand and the direction of rotation of the tools is right hand.

We tried a reamer with a double lead and this gave so much encouragement in the solution of the problem that the tool, illustrated, was made and very satisfactory.

In action the chips were forced up the reamer along the spiral and a smooth hole absolutely to size was the result. A cutting lubricant was used for the reaming operation.

About 2 to 3 thousandths of an inch was left in the hole for finishing reaming operation and using the tool, Fig. 3, a perfect hole to size and interchangeable in its nature was obtained.

Such a type of reamer should prove useful for cast steel parts or steel forgings as well as malleable iron castings.



FIGS. 2 AND 3—ROUGHING AND FINISHING REAMERS.

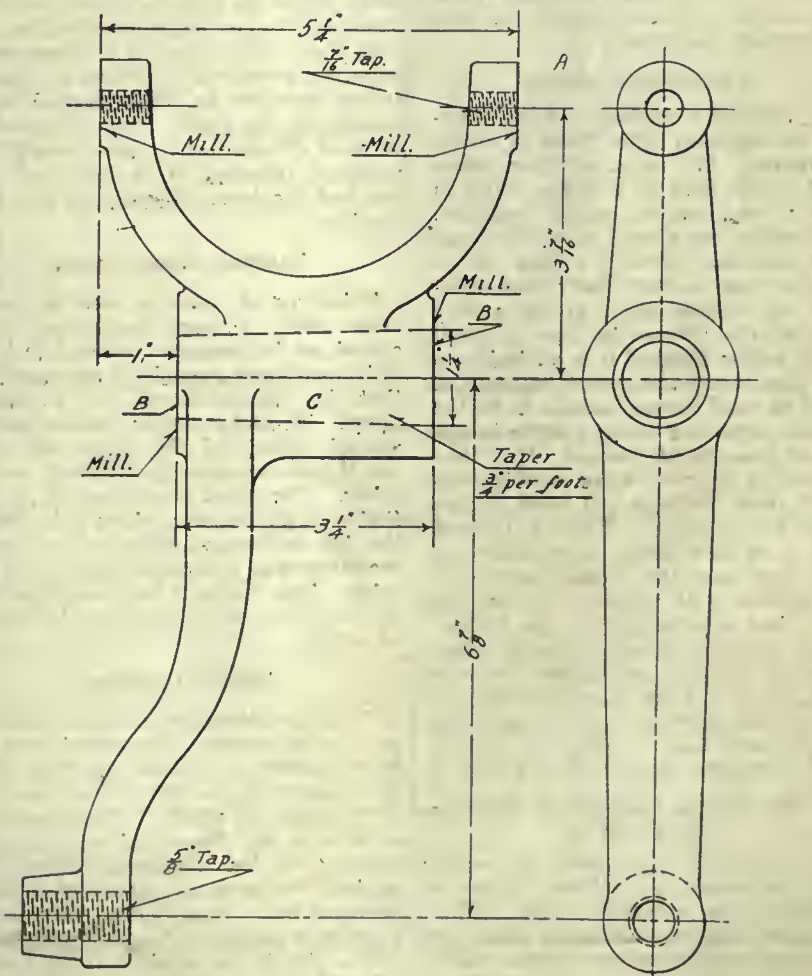


FIG. 11—A VIEW OF THE LEVER ITSELF.

Various Ways of Chucking on Thread Millers

The Chief Points to be Observed in Proper Chucking Are Three in Number. These Are Given, Together With Other Interesting Information Relative to the Art of Properly Chucking Your Work

NO doubt many readers of CANADIAN MACHINERY are interested in thread millers and thread milling in all its phases, so we publish below some matter taken from a bulletin issued by the Smalley General Company, Inc., of Bay City, Mich, relative to the different methods of chucking, and the chucks in use on their type of thread millers.

They commence by remarking that the chief points to be observed in chucking are: 1st. Hold the work so tightly that it cannot slip; 2nd. Hold the work by the parts for which alignment is required; 3rd. Rapidity.

Air-Operated Collet Chucks

The air-operated collet chuck is preferred for most rapid and satisfactory work. It is operated from the operator's position in front of the machine. It is rapid, and furthermore, in chucking rough pieces, if there is a slight slip from a high spot to a low, the air chuck follows it up and tends to grip much tighter. It gives a more powerful bite than can ordinarily be obtained by a hand-operated chuck and therefore holds the article chucked more rigidly. This is of particular advantage when the part to be milled is overhung.

Three-Jawed Chucks

The principle of operation of the three-jawed air-operated collet chuck is simple and familiar. It consists of three collets hinged at the back to a spider which is drawn in and out by an air cylinder. These collets are closed in on the work by an inclined surface sliding on a closing-in ring so that really they operate on an inclined plane giving a very powerful grip. When the piece is small and the article finished it is advisable to use a one-piece collet, which consists of a piece of steel turned outside to fit the closing-in ring and inside a trifle larger than the piece to be chucked. It is then split like an ordinary screw machine collet and given the back and forth motion by the air cylinder. When a tapered thread is to be milled it is necessary in every case that the work occupy the same position with reference to the stop on the bed against which the bottom slide is shoved. In other words, when the milling head is up against the stop which is provided for this work, the position of the hob must be identically the same in each case in reference to the end of the thread to be milled.

Air Collet Chucks Fitted With Stationary Collet

In cases where the work is small enough to permit, a stationary collet is put inside the movable collet. This stationary collet is constructed along the same lines as the screw machine collet but is much larger and is made of cast steel or cast iron. With this device and proper stops on the milling head the work is shoved back into position in the chuck. At the same time the milling head is advanced and shoved into the chuck the proper depth. Then when the air cylinder is operated it does not change its position. If it were not for the stationary collet the piece would be drawn away from the top, an amount equal to the travel of the movable collet, and as diameters of work differ in many cases the amount this movable collet travels inward would decrease with the increase in diameter of the work, thus introducing a variation which of course would be objectionable. Our system of stationary collets has been thoroughly tested and has been found very satisfactory. There are certain points to be observed in the construction of stationary collet chucks. For instance, if the chuck is not properly constructed, concentricity of the work will not be obtained. By our method of construction no variation in the travel of the collets with reference to each other can be introduced. To cite a specific case, we made the largest air collet chuck which we think has ever been constructed. It was used for chucking 16-inch shells. The threads in these shells were not permitted to be out of concentricity over .005 or .006 in regard to the outside of the shell. The Government Arsenal (Watertown), which bought this machine, reported to us that they had not had the least difficulty in this connection.

Tapered Arbor Chucks

This type of chuck is used in certain cases where a large production is required, as for instance automobile hubs. It is sometimes possible to arrange it so that the hob is slipped over a tapered arbor. Then, by simply pulling a ring around outside of the chuck the cams are thrown in which pull it back on the arbor. The piece is driven by a key fitting in the key-way of the hub. When the job is finished the ring is thrown the other way and cams knock it off the arbor. This makes a very desirable sort of chuck in cases where it can be used to advantage.

Adapter Chucking

This is another type of chuck which is used in many cases where the work has to be drawn up against the face plate. The face plate has the proper pilots on it to centre the work. It is operated by a draw-in bar connected with the air cylinder or by a washer forced up against the piece by means of a hand-operated nut. This method of chucking is quite necessary for some work in order to give it the required support when it is so frail or light of section that it would have a tendency to spring.

Difficulties Which Arise and Must be Overcome

This springing brings up another point. In stamping sections made of thin metal or thin castings or in thin tubing, the metal will sometimes spring under the action of the hob, and when the cut is completed be out of true. When this is the case, if accuracy of the thread is required, it is necessary to so chuck the piece that this distortion cannot take place. This is usually taken care of in our collet chucks by chucking the piece on the outside or by expanding mandrels where the piece is held and supported from the inside. In the case of tubing a plug is sometimes driven into the end. Where the piece has a thread on one end and is smaller at that end than at the back end we sometimes put what we call a false collet on the piece. It consists of a spring ring which springs to a slightly larger diameter than the piece on the inside. The outside diameter, which is as large or a little larger than the piece to be chucked, is at the back end. Each time a piece is chucked this piece is placed on the end to be milled and the piece can be shoved back into the collet chuck and is held in place by the false collet which in turn is held in the collet. Sometimes a piece is of such a shape that it is hard to grip it anywhere. Take for instance an old and probably familiar illustration of a shell with a nose thread. The front end of the shell is tapered so that it is impossible to get a hold upon it. If held at the bourillet the overhang of the shell is too much as a slight piece of dirt on the outside of the shell would cause the nose to run out. In this case it was necessary that the thread be concentric with the tapered end, and we made a long chuck something the shape of a cylinder with the sides cut out so that the shell could be dropped in, and at one end of the cylinder was a face plate with a hardened steel bushing in it of such size that it permitted the nose end of the shell to just pass through. A plunger in the back of the cylinder operated by the air cylinder. It shoved the shell into the bushing and at the same time centered it at the back end by means of a conical ring which fitted the base end of the shell. This pressure was sufficient to prevent the shell from turning during the milling operation. This same principle is followed in many ordinary commercial operations.

Milling From the Rough

In many cases the surface to be milled need not be finished before going to the thread miller. If the excess metal is light the part can sometimes be finished with our turning attachment. If the core sand is all removed from castings so as to give a smooth surface they can be milled from the rough. The cored surface of the casting, however, must be fairly true for roundness. Generally speaking, where a surface adjacent to the thread is required to be in true alignment to the thread so as to have a good or perfect contact with the surface against which it presses, this surface can be turned on a Smalley General thread miller at the same chucking.

Special Chucks

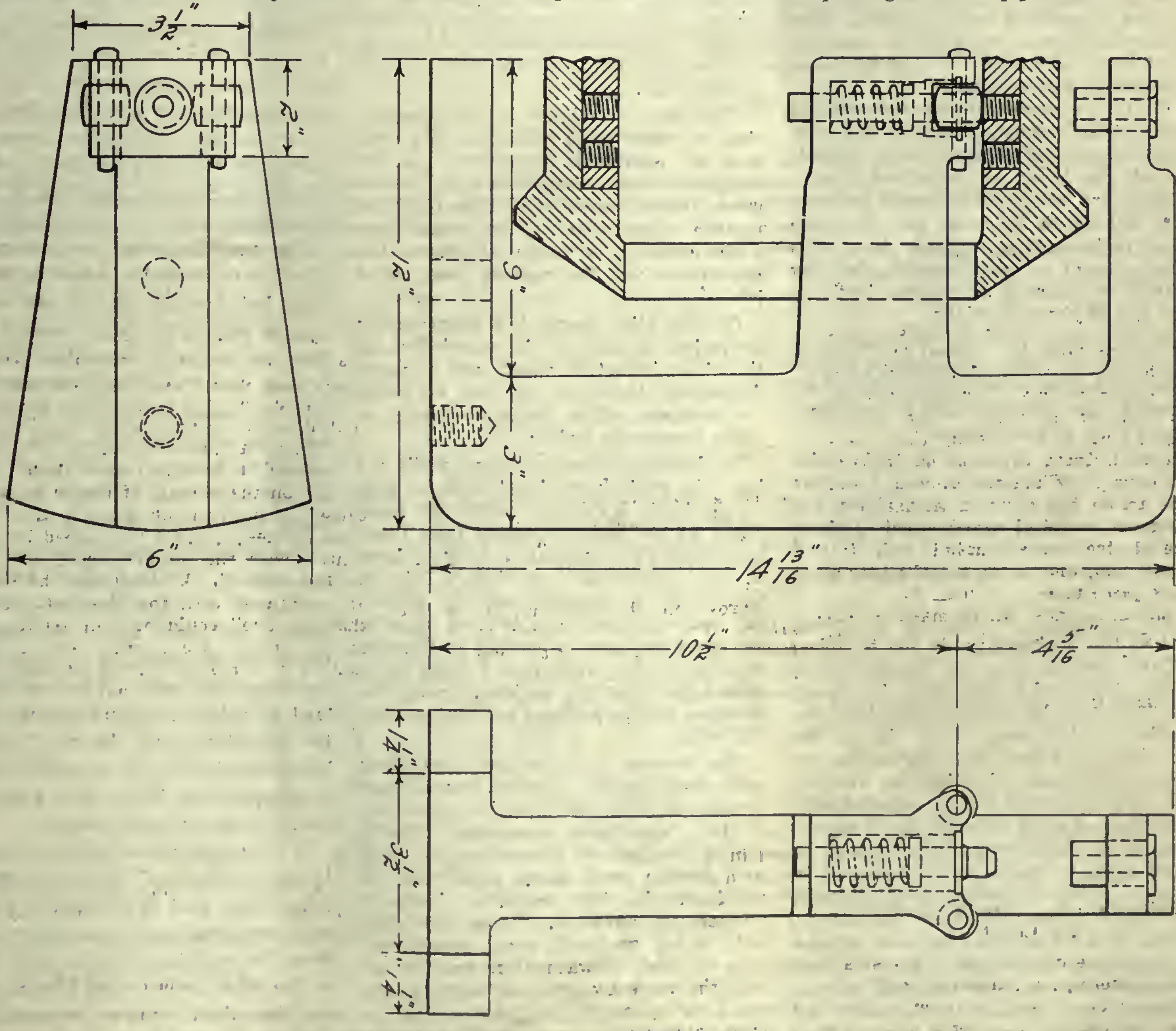
The chucks described above are more or less standard. Where the piece to be milled is unusual in shape, special chucks can be built to insure rapidity in operation and accuracy of the finished part. Attention is called to the fact that in certain cases, as for instance in milling collars or rings, it is possible by the use of a long hob to mill several pieces at one chucking. This materially reduces the net time per piece and the amount of handling. In thread milling the matter of chucking is so vitally important that a word of caution must be spoken. To get proper results with a thread miller the chuck must be mechanically correct and right. It must be remembered that with a thread miller the thread is completed at one revolution of the work by the use of a multiple tooth hob. Hence the stress and strain, the torque and the bite of the hob are greater than in the case of machine tools using a single cutter. Naturally enough it is far from our purpose to suggest fanciful difficulties to those interested in thread milling. But we think it is right and proper to lay stress on the importance of chucking in relation to thread milling, at the same time giving the general assurance that the services of our engineering department are open to any interested person.

DRY PIPE JIG

By C. D. Thorburn and J. Hall

The following sketch illustrates a jig which has proved of considerable value to us in the drilling of new sleeves for old dry pipes.

Frequently we have to renew the sleeve on the end of dry pipe, and the trouble was to get the holes in new sleeve to correspond with holes in the end of old pipe. The old method was as follows: The old sleeve was removed, to transfer and lay out holes some distance up body of pipe. When the new sleeve had been shrunk in position, the holes were again transferred back to it. Very often the man who did the laying off was not accurate, and the result was that when holes were drilled in new sleeve they did not correspond with old holes in end of pipe, frequently causing breakages of drills and taps of holes having to be opened out to a larger size, thereby shortening the life of dry pipe and probably the foreman having to get special oversize plugs made. To overcome above difficulty, the jig, as shown, was designed and made to suit a small sensitive drilling machine, the base of jig being bolted securely to table and the locating pin set central with drill spindle. The dry pipe supported at its middle on a roller trestle and the inside of sleeve end of pipe resting on the rollers in horns of jig. The locating pin, with pressure of spring below, engages in existing holes in old pipe and the bush in top of jig ensures alignment of hole in new sleeve. Result was an accurate job, a big saving of time, and a prolonged life of pipe.



THIS ILLUSTRATES THE JIG FOR DRY PIPES IN DETAIL.

WHAT OUR READERS THINK AND DO

The Functions of a Technical Magazine

By JOHN S. WATTS

THIS article is written for the purpose of suggesting what type of contribution the readers of technical papers wish for.

In a fairly long experience in mechanical work, I have found the technical magazines of inestimable advantage, but still have the conviction that for a variety of reasons they do not fulfil their functions with as high an efficiency as they could.

In the field of mechanical engineering the magazines have, roughly, three main divisions of workers to cater to, these being as follows: Designing, manufacturing, management.

While one reader will be interested in the articles published which fall into that division, in which he is himself placed, the three are so closely interrelated, and the reader himself is probably hoping to be some day in some other division, that it would be a mistake, even if it were possible, for any journal to attempt to confine itself to any one of these divisions.

It may, therefore, be understood at once, that no reader can expect to find every article in every issue to be of interest to him, but we ought to get somewhere near a fair division.

Taking these divisions in their order we have first designing, and I believe this to be the division that needs and uses the technical paper most. I think it could be shown that it is this division which supports the technical paper more than any other.

The reasons I say that the designing end of the business needs the technical papers most is that, in the nature of things, the number of men in the drawing office will be much smaller than the number in the shop, that is, on the manufacturing end, so that while we can, in the shop, subdivide the work so fine that each man will be supplied with that class of work at which he is expert, the man in the drawing office has to be much more versatile and is expected to have a working knowledge of almost everything in the mechanical line.

For this knowledge, he must depend largely upon the technical journals, and as time goes on, and the field of mechanical work extends, he is more and more dependent upon this source. Frequently the designer is engaged in something which is new, at any rate, to his plant, and has generally little to guide him in the way of actual operating experience, with similar machines.

If engineers would publish more information as to the stresses which have proved too high, in machines they have built, and weak points which have developed, we would gain some very valuable information. And under present conditions, when the competition is greater between countries than between companies, the old-time idea of keeping information of this nature secret should be discarded.

The biggest weakness in the organization of most firms to-day is this very lack of operating experience in our draftsmen and designers, and under present conditions can best be remedied by the publication of the weaknesses which develop, by those who have the experience and the remedy that cured it.

On the other hand, the shopman, or operative, is getting his experience, all the time, in actual work, and is more frequently than not working on parts or machines which he has worked on quite frequently before.

In designing new machines, while we have the engineering hand books to give us the basic laws upon which we must build, we get little assistance from these books as to the application of these laws to any particular problem. This is necessarily so, because only the technical journals could hope to keep up with the rapid progress of events in the mechanical world. Therefore, I think there is a great need for articles giving the stresses and proportions used in successful work.

The number of hours spent designing such simple parts, as hand levers, shaft couplings, plain bearings, etc., must be, in the aggregate, enormous. Tables giving the general dimensions of these and similar small parts could well be published in the technical journals, whereas, a handbook being published only every so many years would not care to publish such matter until it had become, in the course of many years, really a standard.

The blame for the scarcity of these really useful articles lies mainly with the designers themselves, because they do not, except in rare cases, send in for publication the tables, charts, etc., that they have got up for themselves. This is partly, no doubt, due to modesty in thinking that what they have themselves done, others can do, or have done, and that the other fellow will probably prefer to get up his own material.

This is not, to my belief, the correct point of view, as I am sure that we are only too glad to avoid the drudgery, and save time where we can by utilizing the work of another.

It should be borne in mind that mechanical engineering, touching as it does almost all the human activities, requires sometimes information on almost every subject under the sun; therefore practically nothing that can be classed as information on any subject whatever, should be rejected, provided it may be reasonably expected to be practical.

The manufacturing or shop end, I think, is much better served by the journals, but I would like to see more attention paid to the time required to perform the operation described. This point is very rarely mentioned in describing a job, but would be valuable for comparison with other methods. The time consumed in doing a certain piece of work is really the final criterion by which to judge the method of doing it.

The third division, management, is, in my opinion, one that would be assisted greatly, if an open discussion could be started and kept up in the paper between the two sides in an amicable and truth-seeking spirit. I believe it would lead to a better understanding between the executives and the men. All embarrassment will be removed and personal animosity if the letters were published under a nom de plume.

It is largely up to readers to make a technical paper of service to them by doing their part in sending in material, both on simple and on obstruse subjects, the one is as likely to be helpful as the other, as we must always remember there is a younger generation coming along.

A SIMPLE MARKING MACHINE

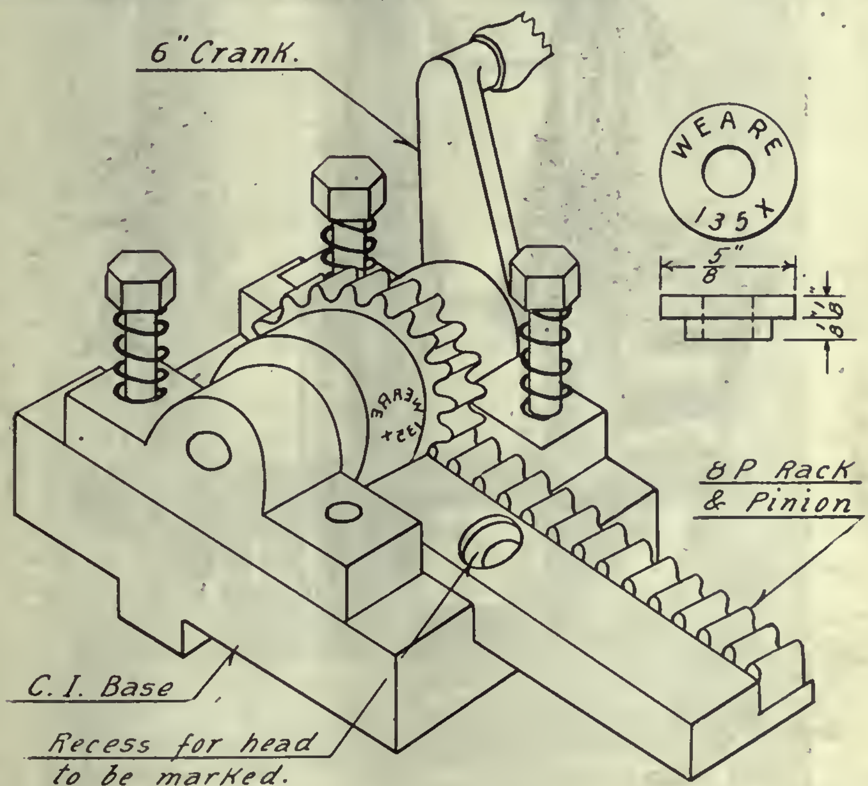
By D. A. HAMPSON

In a recent number of CANADIAN MACHINERY there was described a machine used in making Smith typewriter characters. It brought to mind the device shown above which the writer made up one morning during the rush of war work to mark the round heads shown in the upper corner.

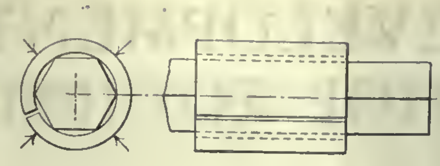
We had slate marking machines and other stamping tools, but there was apt to be congestion on the machine used for these heads. Feeding these small round pieces was slow work at best and so it was decided to try another scheme using the same roll die as the machine.

Some odds and ends were gathered together, a little milling done and some drilling, and the idea of 7 a.m. was the fixture of noon.

In the drawing, one of the screws has been left out for clearness—all four were provided with compression springs to make up for variations in thickness. A tongue allowed the base to be grasped in a vise and with a boy at the end of the handle, five thousand of the pieces could be marked in a day. This kept us ahead of the screw machine and it relieved the marking machine of this job, at the same time doing better and faster work. More than this could not be asked of any device.



GENERAL VIEW OF THE MARKING MACHINE.



HOLDING HEXAGON STOCK IN FOUR-JAW CHUCK.

By F. Horner.

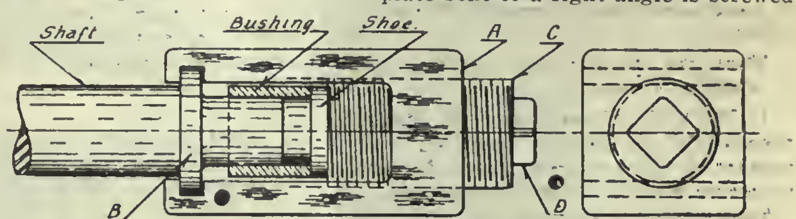
In a case where a lathe happened to be fitted with a nice new 4-jaw self-centering chuck, the following arrangement was adopted to get around the difficulty of holding some hexagon stock, there being no 3-jaw chuck provided. A piece of stout steel tube was taken, of a bore to just slide over the corners of the hexagon, and a saw-cut put through enabled it to centre and grip the bar, the pressure of the jaws coming as indicated by the arrows. The same device might be employed for triangular bar, while, on the other hand, square rod could be chucked when only a three-jaw chuck is available.

FORCING SHORT BUSHINGS ON SHAFT ENDS

By F. SCRIBER

Having had considerable trouble driving the short bronze bushings shown by the accompanying illustration on the shaft owing to their becoming cramped, a tool having the features of construction in Fig. 1 was made for this purpose.

The body of this tool A is cut away at B to hook over the shoulder of the shaft. A screw C having a soft shoe between it and the bushing is contained in this body, thereby causing the bushing to be forced in place by turning the screw with a wrench on the square at D.



THIS VIEW SHOWS THE IDEA.

"SHORT ENDS"

By J. Gray

In a machine shop doing general repair and construction work, a good many pieces of shaft up to a foot or so in length accumulate. These short ends come in very useful for making collars, bushings, pins, etc., and the following method of sorting and storing is considerable of a time-saver, the mechanic being able to lay his hands on what he wants without going through a miscellaneous pile with calipers and rule.

A row of small bins is placed convenient to the lathe hands, and a piece of plate bent to a right angle is screwed on the front face of each bin. The projecting side of this angle plate has two holes drilled in it, one acting as a "go" gauge and the other as a "not go" gauge. The shaft ends can then be speedily sorted into their respective bins and as speedily checked up by the mechanic when one is needed.

U.S. Has Claim.—A claim has been filed by Sidney S. Underwood, representing the United States, for $376,496 and $100,000 damages, against Motor Trucks, Ltd., Brantford. After adjusting its claims with the Imperial Munition Board, the company were awarded $1,633,203, and after various deductions, the amount owing to the company by the United States was $637,812. This was paid, together with an additional $5,000, by the U.S. Government, on November 10th. The U.S. now claim that the value of the lands and buildings making up the company's plant at Brantford were included in the payment, and that the company now refuses to hand over the property to the United States.

Canada Metal Extends.—The large plant of the Steel and Radiation, Ltd., on Fraser Avenue, Toronto, has been purchased by the Canada Metal Company, the price of the buildings and necessary alterations amounting to $250,000. There are six one-storey reinforced concrete buildings, and these will be used for the manufacture of cement tubs, and increasing the nail and wire output, the general smelting and refining business.

DEVELOPMENTS IN SHOP EQUIPMENT

BARNES GANG DRILL

The Barnes Drill Co., Rockford, Ill., have placed on the market a 26 in. all geared gang drilling machine with sliding heads as shown:

This gang drill is built for heavy ordinary type duty work, having same capacity as regular box column type.

It has the strength and power of the ordinary 36 in. cone belt driven drill, and is more conveniently arranged for quick control.

There are no cone and inherent belts to shift or to slip.

It has eight changes each of geared speeds and of geared feeds on each spindle, all independent of each other and all under instant control of operator.

Each spindle is exceptionally large and double splined. Each sleeve has 14 in. travel and drift hole is below sleeve. Head and spindle are counter-balanced, the weight being suspended by roller bearing sheave wheel. The other sheaves are accessible to oil. Head is gibbed to column face, insuring perfect alignment, and is held at any point within the long travel by two quick-acting clamp screws. The head is raised and lowered easily and quickly by means of a crank pinion operating in a rack. An adjustable stop is supplied to clamp on column face so that sliding head may be instantly brought back to exactly the same place each time head is raised.

This machine will drive a 2 in. high speed twist drill at .041 in. feed per revolution of spindle or at the rate of 6½ in. per minute in cast iron, without the back gears.

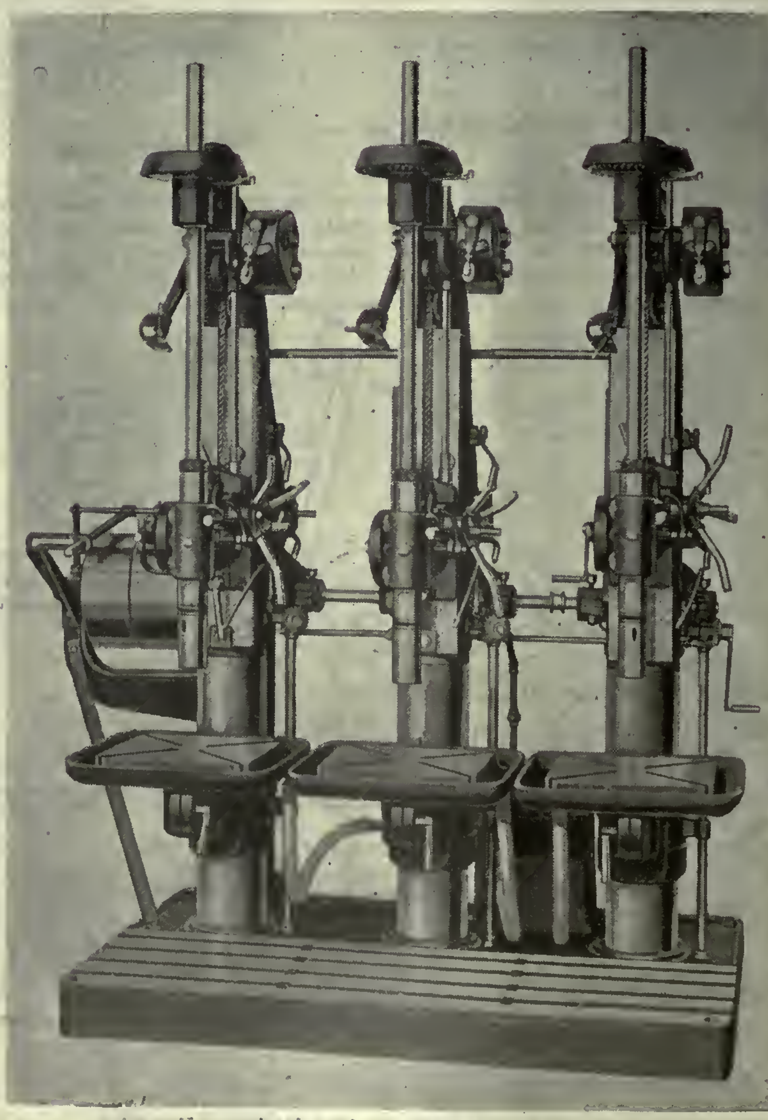
Suitable feeds are available for boring bar work and the machine will bore out an 8 in. hole.

The multiple disc friction clutch gears, giving reverse speed of 1¾ to 1, are on the driving shaft of the machine—not on the spindle—a strong point, as machine is geared down 13 to 1 in front of the clutch gears.

Any or all spindles can be made with ordinary type automatic reversing mechanism. Trip can be set so that the instant tap reaches depth required, spindle will automatically reverse, backing out at increased speed. Shifting lever can also be set so that when tripped automatically (or by hand) it will return to neutral position, thus stopping the spindle instantly instead of reversing same.

Following are the principal specifications:

	Inches
Height of drill	94
Distance from centre to centre or spindles	24
Distance from face of column head to centre of table	12
Distance from turned column to centre of table	13¼
Diameter of spindle nose	3 3/32
Diameter of spindles	1 15/16
Ratio of back gearing	4 to 1
Maximum distance from No. 4 taper spindle to table	40
Minimum distance from No. 4 taper spindle to base	18½
Maximum distance from No. 4 taper spindle to base	53½
Vertical travel of spindle for any position of head	14
Vertical travel of table	20
Vertical travel of sliding head	23
Diameter planed surface square table, exclusive of oil channel	18 x 18
Diameter of round table	23



GENERAL VIEW OF THE DRILL.

PORTABLE OIL BURNER

The Canadian Hauck Burner Co., Ltd., Port Hope, Canada, have placed on the market what is known as their combination Lead Melting Furnace and Portable Oil Burner.

This device is actually two outfits in one. When used as a melting furnace, 200 lbs. of lead or babbitt can be melted in 15 minutes and kept in a molten condition at the cost of a few cents per hour. Additional supply of fresh lead melts instantly.

HAUCK COMBINATION LEAD MELTING FURNACE AND PORTABLE OIL BURNER.

When not used for melting lead in pot, the burner may be detached from the furnace and used for melting babbitt out of bearings, rebabbitting, bending pipes, straightening, preheating in connection with welding, brazing, expanding to make shrink fits, etc.

The device consists of a furnace on three legs, supplied with 200-lb. capacity pot. The 12-gallon oil tank is of heavy steel, equipped with pressure gauge, hand pump and fittings. The burner is of the Hauck Hand Pump Type burning kerosene as fuel. Burner does not consume any air from the tank. The pressure secured by the use of the pump is simply to force the oil to the burner, where it is vaporized. A single pumping will operate the apparatus for three hours.

This device will, no doubt, interest anyone connected with the machine tool industry.

CYLINDRICAL GRINDING MACHINE

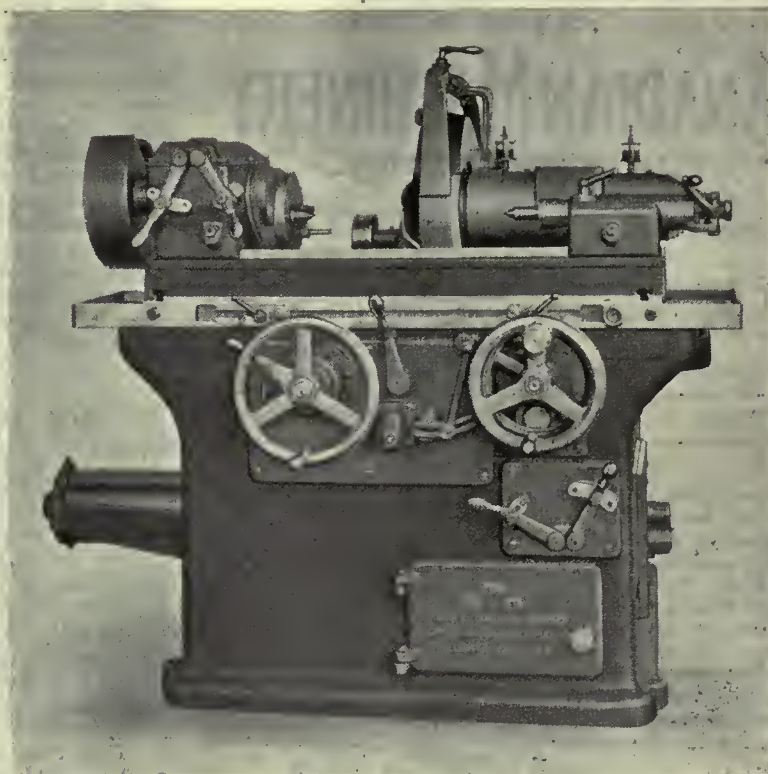
The Fitchburg Grinding Machine Co., Fitchburg, Mass., has placed on the market a line of plain cylindrical grinding machines. The 8 in. by 36 in. size is shown in accompanying illustration.

The wheel spindle is of tool steel, and the spindle boxes of bronze, provided with means of compensation for wear.

The automatic cross feed is operated at each reversal of the table, and is said to be easily and quick set, and is self-releasing when work has been ground to size. The table swivels on a central stud, and can be set to grind various tapers.

The table drive is through spiral gears, rack and pinion. The reversing mechanism is said to be positive and accurate. A coolant tank is cast in the bed and a pump is used of the fan type. The work rest has fine adjustment, and is provided with adjustable set collars for maintaining the size of the work.

The regular equipment includes a wheel trueing device and a centre grinding attachment. The machine is built in six sizes from 4 in. by 36 in. to 12 in. by 54 in. Following are some of the principal specifications of the size shown in photograph:

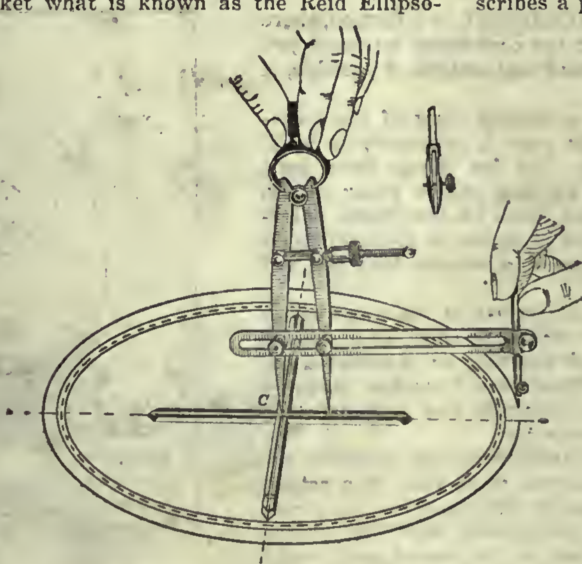


GENERAL VIEW OF THE GRINDER TOGETHER WITH SPECIFICATIONS.

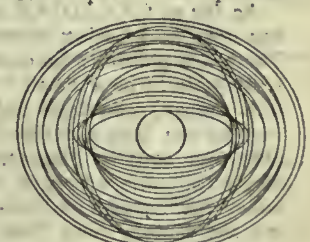
Capacity—Head and Footstock centers swing	8" diameter take 20" length
Swivel plate graduated to angle of	10°
Work Centers, No. 4 Morse Taper	1¼" diameter
Grinding Wheel Spindle front bearing	3" diameter 7⅝" long
Grinding Wheel Spindle rear bearing	2½" diameter 6½" long
Grinding Wheel Spindle Pulley	6" diameter 4⅝" face
Size of Grinding Wheel	16" diameter 1" to 3" face 5" hole
Number of Grinding Wheel Speeds (2)	1400 to 1640 R.P.M.
Number of Work Speeds (6)	64 to 340 R.P.M.
Number of Table Speeds (6)	28 to 150 per min.
Tight and Loose Pulley on Counter haft	10" diameter 4¼" face
Speed of Ball Bearing Countershaft	700 R.P.M.
Floor space at right angles to spindle	52"
Floor space parallel to spindle	83"
Net weight, about	4100 lbs.

REID ELLIPSOGRAPH

Daniel C. Reid, 2717 N. Croskey Street, Philadelphia, Pa., has placed on the market what is known as the Reid Ellipsograph. This instrument is claimed to draw all kinds of ellipses or ovals, from 1½ in. up to 12 in. major axis, and describes a perfect ellipse in one operation.



THIS VIEW SHOWS THE INSTRUMENT IN USE.



THE WORK ACCOMPLISHED

The instrument is provided with pen and pen parts, and can also be used for drawing circles up to 12 in. diam. It can also be used as an ordinary divider. This announcement will no doubt appeal to draftsmen, designers, illustrators, architects, etc. To illustrate its construction we show the illustrations herewith.

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PRINCIPAL CONTENTS

Another Strike This Year?

ALTHOUGH the first of May is some time distant, there are rumors abroad already that there will be labor disturbances in the metal working industries at that time.

The memory of the trouble of 1919 is still fresh in the recollections of the industries in this district.

That struggle came at a time when it could not help but make the business of after-war manufacturing hard and difficult. No good purpose has been achieved by the strike of 1919. There are mechanics in all lines of the trades — machinists, molders, etc.— who are to-day living in distant cities and towns where they have poorer conditions than they left here.

There are shops that are manned with help not as efficient as that which walked out on the first of May last year.

As far as CANADIAN MACHINERY is informed, there has been no meeting between the conflicting interests yet. There are points to be discussed and settled, if possible, if a strike is to be averted.

A person need take only a cursory view of the situation to see that a strike this year is extremely undesirable and equally dangerous. So far things have gone nicely, but the pressure of keeping things going nicely, under the burden of increased costs of everything entering the factory, and from the pressure of uncertainty in the supply market, is putting on a tension that has not an inexhaustible resistance.

If Canadian industry has not arrived at the stage where the men in the shop and the men in the office, or in charge of the organization, can meet together as reasonable beings, and discuss their problems, then Canadian industry has not arrived at the stage where it can anticipate the future with confidence and certainty.

The editor of *Canadian Foundryman*, who made an unsuccessful attempt to bring about some kind of a settlement, writing in the last issue of that paper on the strike outlook, stated: "While we sympathize with the molder more than with any other man in the world, and would gladly do anything in our power to assist him, we cannot help but think that he is the loser in the long run by not keeping himself better informed. Had the molders taken the trouble to look the situation squarely in the face last spring, and weigh the possibilities of winning out, they could not help but have seen that the odds were against them, as there was hardly a shop on the continent but what was slack. Things are more favorable now, and there is no reason why every molder is not holding down a good job at his trade. What this paper would suggest would be for the foundrymen to offer the molders a wage such as would support life, and then for the molders to go to work and make hay while the sun shines, and when things get down to normal and work shows signs of slacking off it would certainly show a brotherly spirit to reduce the hours of labor rather than allow some of the men to be laid off, but just now it does not seem possible to get the 44-hour week, and inasmuch as the bulk of the foundries in the United States and Canada are working at least 48 hours and made very little effort to have it reduced, there was not much chance for a few Canadians to win out, even though it might be desirable."

WE Pay For All These Things

WHO is putting up all the increases in wages, selling prices, etc.?

We are.

There's something to think about right there. The employer makes a serious statement about it hurting him. So it does—but not for long.

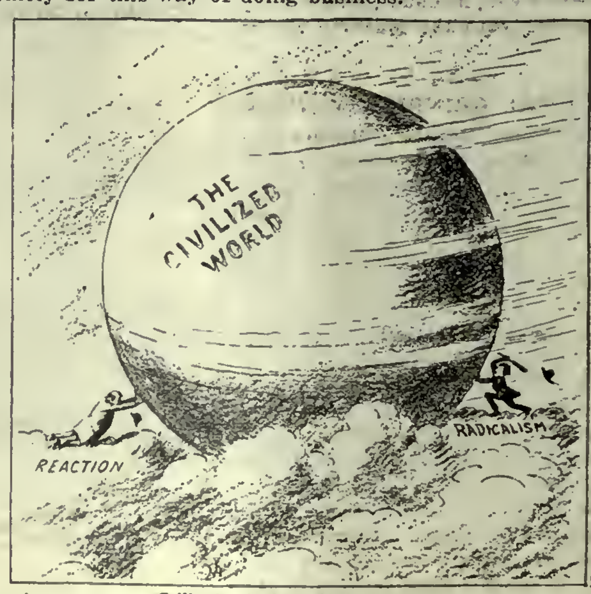
Take a case in the mechanical world. A firm wants a boring mill. A ten per cent. advance is announced. They buy the mill, pay the old price and the ten per cent. as well. It becomes part of the charge against which they must work until depreciation has amounted to sufficient to write it off.

That firm is making a certain article. If they are modern, their cost prices will be kept right up-to-date. That increase in the price of the machine must increase the price of the operation—that is if there is not sufficient increase in production to more than meet it.

If the firm sells to the wholesale trade, a little more is charged. The wholesaler passes that "little more" on to the retailer. The general public—WE—get it last. We have no person to pass it on to, and we pay it.

Every time any section of the community, by favorable conditions or extraordinary circumstances, grabs off a little larger portion of cash or goods, WE pay for it.

WE can take it for granted now that when a city throws up its hands after counting noses, and announces a big increase in population, that it has simply gathered them in from the small centres and the farms. The larger the cities, the less people on the land. And we pay handsomely for this way of doing business.



Still the World Goes On!

New *Industry* Largely the Outcome of an Article in This Paper

ABOUT a week ago one of our editors visited the plant of the Fisher Motor Co., Orillia, Ont., to prepare an article on their die casting plant and was rather surprised to see on the president's desk, a worn and well-thumbed copy of CANADIAN MACHINERY that was over six months old. He suggested to Mr. Vollans, the president and manager of the concern, that he get rid of the old copy. "Get rid of it," was the reply. "Well I should say not. It was that copy of CANADIAN MACHINERY that started us in the die casting business."

It transpired that one of our staff had written an article on the subject of die casting in that particular issue, which this concern had used as a guide to work from.

Mr. Vollans was also good enough to state that to his mind CANADIAN MACHINERY was a paper to be proud of. He mentioned that he read the magazine every week from cover to cover, always finding something of interest and value to him.

It is encouraging to know that our efforts are being noticed and appreciated by executives such as Mr. Vollans and no doubt others who do not like to thus openly comment on our work.

MARKET DEVELOPMENTS

Steel Turning in Favor of the Consumer Now?

Indications Are That the Peak Has Been Passed and the Runaway Market Has Ceased—New York Reports a Decided Falling Off in the Inquiries for Machine Tools

THE steel market may be turning in favor of the consumer by a trifle, and it may take a little time to notice the change, but it seems to be on the way. The month of February showed a good increase in mill production over the figures of January. The runaway market has done about its worst, and anything that comes now will probably show a tendency to fall from the high-water mark. The New York reports indicate that there has been a falling off in the inquiry for machine tools, and sales are not closed as readily as before. There is some uncertainty regarding future prices and conditions, and this always tends to keep buyers from committing themselves to large investments.

Although the first of May is some distance away, there is talk in this district of labor trouble in the metal trades unions. Many of the strikes that were called last year are still in existence, and it is difficult to see where a second strike can be called. No conferences have been held to try and come to an understanding.

Manufacturers are having a serious time in many cases, being held up for want of material. Sheets, plates, tubes, etc., are very scarce, and a lot of work is being held up for want of boiler tubes. They are so scarce that many of the warehouses cannot even furnish a price on seamless tubes.

Machine tool dealers have a number of good prospects for future business, and the general volume of trade from this field is very good, with no indications of any slackening.

Scrap metal is moving more freely, some of it no doubt being brought about by the higher figures that are offered now. An indication of the scarcity of this class of stuff is furnished by the number of dealers who have been eager to get a chance to bid on the scrap value of an old power plant that was being scrapped north of Toronto.

PRICES TOO HIGH TO PERMIT WAREHOUSES TO PUT MUCH IN STOCK

Special to CANADIAN MACHINERY.

MONTREAL, Que., Mar. 18.—Transportation has again met with a serious setback from the storm of the week-end and temporary inconvenience has been experienced in this district. The St. Lawrence Valley has suffered considerably and Quebec City and vicinity were particularly hard hit by the severity of the ice and snow.

Delivery Shows Improvement

The belief is becoming general that the apex of steel prices has not yet been reached and that the spring demand for building material and reconstruction work on the railroads will tax the capacity of the mills and storehouses throughout the entire summer. As a matter of fact, there is little prospect of warehouse stocks becoming a source of supply for some months to come, as current conditions are not very favorable for accumulation of material. The abnormal prices that govern the trading in steel, while in keeping with present conditions, are nevertheless of such a character as to prevent any heavy buying for future business. The transient movement of material has shown improvement, but rail shipping has been somewhat uncertain during the past week. While firmness marks the current quotations, there is a feeling that prices will be further advanced on some lines.

Good Demand for Tools

The demand for machine tools is still of such a character that it is taxing the best efforts of the dealers to meet the wishes of their customers. While the present requirements are not abnormal, the inability to obtain delivery of tools is a serious handicap to business. The apparent scarcity of standard used equipment is another factor that enters into the present problem of supply and demand. Many dealers have reported a good business in disposing of machinery that has been overhauled and repaired, and in some cases rebuilt. While the prevailing high costs are a deterring buying factor, this circumstance is generally surmounted if early delivery is guaranteed.

There is comparatively little change in the old material situation. The buying of iron and steel scraps continues very active, but there is still great difficulty in meeting the full requirements of the mills and foundries. The insistent demand for machinery scrap has practically depleted every possible source of supply, so that the present market is one of supply rather than one of cost. Little reliance can be placed on quoted prices, as individual sales are invariably made on their own specific conditions. The continued active operations of the mills during the past year has occasioned the absorption of almost all the available heavy melting scrap, and the requirements of the trade at present are apparently taking care of the current supply. The non-ferrous market is quiet, but movement is steady. Prices are unchanged, but nominal, and the general situation is of a stronger tendency.

A New Appointment.—Mr. L. M. Jones, city engineer of Port Arthur, has been appointed engineer on the staff of the Warren Bituminous Paving Co. Mr. Jones will take charge of all the Toronto work of the firm. He has been city engineer of Port Arthur for the past nine years, and was at one time engineer for the Winnipeg Electric Street Railway.

PREMIUM GOODS ARE COMING NOW

Trade Is Good, But Buyers Are Not Anxious to Get Stocked Up Far Ahead

TORONTO.—The arrival of a certain amount of premium material at some of the warehouses is about the only thing that is breaking the monotony of the situation which can best be described as doing business on an empty market.

Dealers who get in premium material are not placing it in stock—not by any means. They are getting it out to the trade just as quickly as their means of distribution will permit, and the trade is not at the state yet where it backs up at the price as long as the actual material is there with it. It is still a case of getting the material and settling the question of the price after.

There is very little improvement in the machine-tool trade, as far as getting shipments through is concerned. Of course, the recognized dealers always have more or less coming through for stock, and in this way are able to often improve on the delivery schedule that might otherwise be adhered to.

A Toronto dealer who has been at several of the American machine tool centres reports an incident that indicates the extent to which new buyers are coming into the market. While he was at the office of a well-known firm of machine tool builders, a representative of the Soviet Government of Russia was also there. His mission was to secure a line of samples from machine tool houses that were to be used for the equipping of machine shops in various centres of Russia. The conditions under which the purchase was to be made were apparently quite satisfactory to the makers. The agent of the Soviet agreed to pay one-third down at the time of the order, and the remainder on shipment. Payments were to be made in gold, so there was no doubt about the financial backing of the Government. It was understood that very large orders were to be placed as soon as it had been decided just what equipment was to be placed in the Russian shops.

Some very nice orders are being placed in the way of equipment, and they are coming from a wide range of territory.

Although there is no tendency on the part of the trade to go slow on taking business, there is a much keener watch kept in many places on the quantity of material that is being passed into stock. Buyers are ordering for two or three months in advance, whereas, in former times, they have bought of certain standard lines enough, when shipped at intervals, to keep them going for a year. One dealer explained the position of his house on this matter: "We would rather lose a little business through not having certain lines than keep on piling in material that we have to secure from a market that is at the peak of high costs." This feeling is having the effect of helping many of them get their house down to a safe margin for anything that turns up. In one way, it is creating a situation that will keep up a demand for some time to come, as stocks by this process will be greatly reduced.

Prospects of labor troubles in this district are not entirely remote, and even at this stage they are spoken of as an influence that may have much to do with the industrial situation and the machine tool market. So far as we can learn, there has been no meeting of the men and their employers to discuss matters, and circulars have been issued at various times calling on the men to get organized in view of trouble that might arise.

An Empty Market

A fairly good indication of the market at present for such material as seamless tubes is furnished by the fact that several of the warehouses in Toronto are not able to correct the price list that is published on another page in this section of the paper. It may be gauged from the other list that goes with it, viz., lap-welded. One firm volunteered the information that a 2-inch tube was worth 32 cents per foot at the present time. There is need for tubes, many of the cases calling for them being bona fide repair jobs that are badly needed.

Canadian mills are doing much better in the matter of supplying the trade here. Bars and shapes are coming in much better than for some time. Shipments of ten gauge sheets are also arriving, but the trade that gets these must recognize that the dealers are paying a good premium for them, and the price is quite well above the regular prices they have been accustomed to pay.

The Scrap Market

Dealers in the scrap metal trade are satisfied to let the prices marked up last week stand for the present. The increasing prices, especially for ferrous metals, is having the tendency of bringing more offerings into the market.

The demand for anything in the line of material grows more keen. For instance, the fact that a power plant north of Toronto was about to be scrapped has brought forth any number of prospective buyers for all the material that was contained in it. There is undoubtedly a shortage of cast scrap and heavy melting steel, while little has come in to help out the stove plate shortage.

Coppers have been weaker during the week. There is no particular explanation for the fact, but it is apt to fluctuate owing to the uncertain conditions in the large copper markets of the world.

New metals stay at last week's prices. Coppers of all kinds are quoted for resale by jobbers around 24 cents. Tin stays at 78 cents. The chances seem to be that it will not go higher, although a short time ago it was freely predicted that it would again touch the dollar mark.

POINTS IN WEEK'S MARKETING NOTES

Production at U. S. steel mills showed an increase of eight to nine per cent. in February over January.

The steel trade seems to consider that the premium mills have gone to their peak, and that hereafter there will be a change for the better from the point of view of the consumer.

The finished rolled steel capacity of United States mills is now placed at over three million tons per month.

The pig iron market seems to be much quieter now, in fact Pittsburgh refers to it as stagnant.

Premium material is arriving in Toronto, and is being sold at premiums with no trouble at all.

Canadian mills are sending out good shipments of bars and shapes.

Scrap metal markets are firm. There is a decided scarcity of cast iron, heavy melting and stove plate.

Buyers are fighting shy of taking on more stock than they can immediately use on account of prices. This tends to keep warehouses bare.

New York reports a falling off in the demand for machine tools. Whether from price or uncertainty is not known, but there are inquiries who are retiring now before placing the orders.

Although the first of May is some distance off, there is talk of a strike in the metal trades industry in Toronto district.

SLUMP NOTICED IN NEW YORK MARKET

Dropping Off in Demand for Machine Tools—Some Foreign Buying Has Been Done

Special to CANADIAN MACHINERY.

NEW YORK, March 18.—As has been noted in recent weeks the volume of inquiry for machine tools has been on the decline. The past week in the New York market was the quietest in some time. Not only have inquiries fallen off, but many prospective buyers show no inclination to close for machines for which they recently inquired. Just how much this condition is due to the uncertainty due to the financial situation and how much to the high prices and long deliveries is difficult to determine.

The only inquiry of importance now before the trade in this market is from the Otis Elevator Co. for its Yonkers, N.Y., plant and calls for quotations on about 70 machines.

Much of the Government surplus of machine tools will be taken to France by the French commission now in this country making selections. Last week a member of this commission bought a large part of the surplus equipment at the Watervliet Arsenal, Watervliet, N.Y., and other Government plants and warehouses are being visited.

IS THE STEEL SITUATION TO CHANGE IN FAVOR OF CONSUMER?

Special to CANADIAN MACHINERY.

PITTSBURGH, March 18.—While steel is almost, if not quite, as scarce as formerly, there are signs that the situation is changing in favor of the consumer. There are various reports of consumers receiving much heavier deliveries than formerly. One consumer, for instance, received nineteen carloads of steel bars in a week, much beyond the usual amount, and could unload only ten cars. He very cheerfully paid demurrage on the other nine cars. Another point is that on some commodities the top prices paid in the last few days for the earliest deliveries are not altogether up to the top prices of two or three weeks ago. Sheets, for instance, sold up to the basis of 10 cents for common black in the last week of February, but would not bring altogether that price now. Possibly another indication is that some large independents, which only recently covered customers for second quarter, now state that they will probably make prices to customers for third quarter by April 15. If they expected the shortage to increase they would probably hold off as long as possible.

Increased Production

By far the most conclusive evidence, because of its being comprehensive and altogether authoritative, is the report of steel ingot production in February. The American Iron and Steel Institute reports that thirty companies, which in 1918 made 84.03 per cent. of the country's output, produced in February 2,865,124 gross tons of steel ingots. This means that the industry produced in February at the rate of 44,200,000 tons a year, this comparing with a rate of 40,650,000 tons in January, thus showing an increase for one month of between 8 and 9 per cent. The January production was, of course, much greater than the production in the closing months of last year. The monthly ingot report was omitted for the last four months of last year, but it may be estimated that the rate was about 22,500,000 tons on October 1, when the iron and steel strike was at its height, and about 37,500,000 tons on December 31, when the strike was over; but there was still something to be done by way of getting mills in shape for efficient work. For the whole quarter, or, practically speaking, for the period of the strike, production was at the rate of about 29,000,000 tons a year. When January shows a rate of 40,650,000 tons and February a rate of 44,200,000 tons, it is going to make quite a difference in the supply of steel to jobbers and manufacturing consumers. There was almost as much steel made in January and February as in the preceding three months.

March will, undoubtedly, show a large increase in production over February. In the first place, there were transportation difficulties which restricted production in February, and these difficulties have been gradually disappearing, though they are not all out of the way yet. In the second place, bad weather always directly affects tonnage output, and March is always a particularly good month for outputs.

Output and Prices

A large output or a small output does not affect the market, if expected. If unexpected, it does. This large output was not expected. A number of producers last December were predicting that they would be able to operate at only about 75 per cent. during the first quarter of the new year, say, 65 per cent. in January, 75 per cent. in February, and 85 per cent. in March. That would relieve the steel shortage produced by the strike only very slowly. The quarter's output promises to be about 90 per cent. instead of 75 per cent. There is no doubt that many consumers expected a light output for the quarter. It was very largely the consumers who made the rapidly advancing market, by bidding higher and higher prices when they found mills unwilling to sell. If those who made the market acted upon misapprehensions, then the situation created does not rest upon the proper foundation, and will have to align itself to the actual facts.

Railroad Steel

There has been a great deal of loose thinking and talking about the railroads. Clear distinctions should be made between railroad "requirements" or "wants," railroad buying, and deliveries to railroads. The railroads might want a great deal more than they needed, or they might need a great deal more than they could pay for or than their managers would be willing to buy. Thus requiements and buying are different things. Purchases and deliveries are also a different thing. There may be purchases that it would take a long time to complete. The car shops have to build up working organizations again, no easy task by any means, and they will be quite busy for some time to come with repair work. It is possible that the shops could not build more than about 50,000 cars, in addition to export and other orders already booked, up to the end of the year. If so, it would make no difference to the steel supplies, to other consumers of steel, whether the railroads should, at this time, buy 50,000 or 250,000 cars, the car shops would take just the same quantity of steel deliveries this year.

Freight car orders on this movement, a few having been placed already, will probably total between 50,000 and 100,000 cars; but for 50,000 cars only about a million tons of steel would be required, and the industry's capacity, in all finished rolled steel, is over three million gross tons a month. As to rails, nearly all the buying for this year has already been done, and places no great burden on the mills. Locomotives are a smaller item than rails or cars in point of quantity of steel required. As to bridge, buildings, improvement of terminals, block signalling, etc., much work will, no doubt, be done; but there is much engineering work and planning to be done first, also some financing. Steel required along such lines will be needed in 1921 and 1922 rather than this year.

A great many consumers of steel, however, expected the railroads to buy in such manner that there would be heavy drains upon the steel supply this year, beginning, perhaps, as early as March or April. That was a prodigious mistake.

If a large number of steel consumers made two mistakes, by underrating the production of steel in the fore part of this year and by overrating the quantity of steel the railroads would get, then the market they made, or helped to make, proceeding on those theories, requires correction.

In other words, the price runaway in steel is probably over. It has gone as far as it is to go, and it has chiefly affected prices for early deliveries, which are likely to sag. The Steel Corporation's prices, which are on the March 21 or Industrial Board schedule, are not in danger and are, indeed, low by consideration of all circumstances, without taking into account the higher prices secured, on relatively limited tonnages, by independents. The prices lately quoted by large and conservative independents, prices which they probably will not exceed, and may conceivably shade, for third quarter, are not especially immoderate, being about 3 cents for bars, 3.0 cent for shapes, and 3.25 cents for plates, $13 a net ton in the case of bars and shapes, and $12 in the case of plates, above the March 21 schedule.

Pig Iron

The pig iron market has been almost stagnant. If the market is not actually weak, it is not particularly strong, and it certainly shows no advancing tendency. The premiums on prompt foundry iron have disappeared entirely. The pig iron market is much older than the steel market, and, presumably, it has exhibited all the varieties of which it is capable. One thing has never occurred, and that is for there to be a high market and at the same time for there to be no premium for prompt delivery; yet that is the condition to-day. The market is quotable at $42 for Bessemer and foundry, $43.25 for malleable. and $41.50 for basic, at valley furnaces, with $1.40 freight to Pittsburgh.

PIG IRON TRADE

Basic iron is on a firmer footing, the recent irregularities in price having been smoothed out. Foundry iron is holding its price well. Following are reports from U.S. points:

There have been a number of transactions in low phosphorous iron for second quarter at $47 furnace. Further tonnage of Bessemer for export was sold at $45 Eastern Pennsylvania furnace. Foundry iron of 1.75 to 2.25 silicon is at $44 to $45 for first and second half, Eastern Pennsylvania furnace.

CHICAGO.—The market has been quiet here, but there is a certain amount of business being done quietly. Basic iron, spot, is quoted at $45 Chicago furnace. Enquiries for 2,000 tons foundry and 1,000 tons malleable are out.

CLEVELAND.—Foundry iron is firm on a basis of $42 valley furnace. Several thousand tons have been sold during the week at this figure, and some hundreds of tons of malleable at $44.50 furnace. Basic is settled at $43 valley furnace.

PITTSBURGH.—Basic is established at $43 valley furnace, although some sales were made at $41.50. These lots, however, had been contracted for several weeks ago at the lower price. Foundry iron is $42 minimum.

BOSTON.—New England is still suffering from transportation difficulties. A fresh storm came along just as freight was beginning to move and put deliveries back still further, with the result that several furnaces were compelled to close down; $60 furnace is by no means an unusual quotation for pig iron. Iron for delivery in last half is at $45 base grade Buffalo furnace.

NEW YORK.—The demand for pig iron has been small, and prices are about the same; that is, $43 to $44 Eastern Pennsylvania furnace for 1.75 to 2.25 silicon, and $44.25 to $45 for 2.25 to 2.75 silicon. Basic and Bessemer have been sold in small lots for $42 to $42.50 Eastern Pennsylvania furnace.

BUFFALO.—Sales of foundry iron amounted to about 4,000 tons, the prices being $45 for 1.75 to 2.25 silicon, with $46.25 and $48 for the next grades; 7,000 tons basic was sold to a Canadian customer at $43.

ST. LOUIS.—Owing to deliveries on contracts being so far behind, owing to car shortage, there is a good demand for spot iron. Foundry iron, 1.75 to 2.25 silicon, for spot, is quoted at $42 to $43, and $40 for last half delivery.

BIRMINGHAM.—There is a fairly good market, though not so much activity is being shown as has been the case recently. The 1.75 to 2.25 silicon grade is quoted from $38 to $43. A round tonnage was sold for $40, last half delivery.

BUFFALO.—1,000 tons heavy melting steel at $26.50 was the only transaction in this grade during the week. There has been some enquiry for low phosphorous scrap, and 3,000 tons of this grade were sold at $32.50.

CLEVELAND.—Dealers are inclined to hold out for higher prices, heavy melting steel being quoted at $27 to $27.50. There are pretty good-sized stocks in dealers' yards, but it is mostly all sold. The market may be said to be in a strong position.

CINCINNATI.—There has been good demand for foundry scrap, and rolling mill scrap has been bought freely. Stocks, both of dealers and those in furnace yards, have been considerably reduced. The market is strong and active.

ST. LOUIS.—Trading has been confined mostly to dealers, and while some slight revisions of prices downwards have occurred, they have been in the nature of adjustments. Relaying rails are at $52 to $55. Cast iron borings and malleable grades are strong.

U.S. SCRAP METAL

While the market is quiet, the decline in prices has been checked. There is weakness in some districts. Following are reports from various U.S. centres:

CHICAGO.—There is a better feeling in the market, and the decline in prices noticeable last week has been checked. On some classes of scraps slight advances have been registered. The car shortage is still in evidence.

PHILADELPHIA.—There has been some activity in steel scrap, the price obtained being $26 delivered. Borings, which are rather scarce, have sold at $25 delivered. A large steel works bought 12,000 tons low phosphorous scrap.

BOSTON.—Some softening of prices is in evidence here, due to lack of demand, caused in turn by shortage of coke. Machine shop turnings are quoted at $16.50 delivered dealers' yards, and borings have declined $1. No. 1 machinery has sold at $46 delivered. Cast scrap is in good demand.

NEW YORK.—The market is weak, though prices remain unchanged. Shipments to New England points are still held up by embargo, but outgoing shipments are moving. Borings and turnings are the only active grades.

PITTSBURGH.—There is little trading, and the transportation situation is still very bad. Heavy melting steel has changed hands between dealers at $27.50, but it is doubtful if consumers could get a lower quotation than $29 delivered.

Donahey in the Cleveland "Plain Dealer."

"Eliza."

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$42 40
Lake Superior, charcoal, Chicago	57 00
Standard low phos., Philadelphia	50 00
Bessemer, Pittsburgh	43 00
Basic, Valley furnace	42 90
Toronto price:—	
Silicon, 2.25% to 2.75%	52 00
No. 2 Foundry, 1.75 to 2.25%	50 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 50
Steel bars, base, Toronto	5 50
Iron bars, base, Montreal	5 50
Steel bars, base, Montreal	5 50
Reinforcing bars, base	5 00
Steel hoops	7 00
Norway iron	11 00
Tire steel	5 75
Spring steel	10 00
Band steel, No. 10 gauge and 3-16 in. base	6 00
Chequered floor plate, 3-16 in.	9 40
Chequered floor plate, ¼ in.	9 00
Staybolt iron	9 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	4 00
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 90
Small shapes under 3"	3 62

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points	C.L.	L.C.L.
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

Gross.

	Montreal	Toronto
Lake copper	$25 00	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	77 00	76 00
Spelter	12 50	12 00
Lead	12 00	12 00
Antimony	14 50	14 00
Aluminum	34 00	35 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 7 25	$ 7 25
Plates, ¼ up	6 50	6 50

Price List No. 38

WROUGHT PIPES

Standard Buttweld

Per 100 feet

	Steel Blk.	Steel Gal.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Gal.
⅛	$ 6 00	$ 8 00	$.....	$.....
¼	4 83	6 96	5 31	7 44
⅜	4 83	6 96	5 31	7 44
½	6 42	7 99	7 10	8 67
¾	8 11	10 24	9 03	11 16
1	11 99	15 13	13 35	16 49
1¼	16 22	20 47	18 06	22 31
1½	19 39	24 48	21 59	26 68
2	26 09	32 93	29 05	35 89
2½	41 24	52 07	.....	.....
3	53 93	68 09	.....	.....
3½	68 54	85 56	.....	.....
4	81 21	101 37	.....	.....

Standard Lapweld

Per 100 feet

	Steel Blk.	Steel Gal.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Gal.
2	$29 79	$36 63	$33 49	$39 96
2½	43 58	54 41	49 43	60 26
3	56 99	71 15	64 64	78 80
3½	70 38	87 40	79 58	96 60
4	83 39	103 55	94 29	114 45
4½	.95	1 19	1 20	1 45
5	1 10	1 39	1 40	1 69
6	1 43	1 80	1 81	2 19
7	1 87	2 36	2 34	2 83
8L	1 96	2 48	2 46	2 98
8	2 26	2 85	2 84	3 43
9	2 71	3 42	3 40	4 11
10L	2 51	3 17	3 15	3 81
10	3 23	4 08	4 06	4 90

Terms 2% 30 days, approved credit

Freight equalized on Chatham, Guelph, Hamilton, London, Montreal, Toronto, Welland.

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.
4½" and larger 50%.
4" and under, running thread, 30%.
Standard couplings, 4" and under, 40%,
4½" and larger, 20%.

OLD MATERIAL

Dealers' Average Buying Prices.

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$15 00	$14 00
Copper, crucible	18 00	18 00
Copper, heavy	18 00	18 00
Copper wire	18 00	18 00
No. 1 machine composition	16 00	17 00
New brass cuttings	11 00	11 75
Red brass cuttings	14 00	15 75
Yellow brass turnings	8 50	9 50
Light brass	6 50	7 00
Medium brass	8 00	7 75
Scrap zinc	6 50	6 00
Heavy lead	7 00	7 75
Tea lead	4 50	5 00
Aluminum	19 00	20 00
	Per Ton	Gross
Heavy melting steel	18 00	18 00
Boiler plate	15 50	15 00
Axles (wrought iron)	22 00	20 00
Rails (scrap)	18 00	18 00
Malleable scrap	25 00	25 00
No. 1 machine cast iron	32 00	33 00
Pipe, wrought	12 00	12 00
Car wheels	22 00	26 00
Steel axles	22 00	20 00
Mach. shop turnings	11 00	11 00
Stove plate	25 00	25 00
Cast boring	12 00	12 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜" and less	15
Carriage bolts, 7-16 and up	Net
Coach and lag screws	30
Stove bolts	50
Wrought washers	50
Elevator bolts	5
Machine bolts, 7-16 and over	10
Machine bolts, ⅜" and less	20
Blank bolts	25
Bolt ends	10
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square blank	add $1.50
Nuts, square, tapped	add 1 75
Nuts, hex., blank	add 1 75
Nuts, hex., tapped	add 2 00
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent.
Set screws	40
Sq. and Hex. Head Cap Screws	35
Rd. and Fil. Head Cap Screws	5
Flat But. Hd. Cap Screws	10
Fin. and Semi-fin. nuts up to 1 in.	35
Fin. and Semi-fin. nuts, over 1 in., up to 1½ in.	25
Fin. and Semi-fin. nuts over 1½ in., up to 2 in.	10
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws list plus 20,	30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$60 00
Open-hearth billets	60 00
O.H. sheet bars	76 00
Forging billets	56 00-75 00
Wire rods	52 00-70 00

Government prices.
F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 70
Cut nails	5 85
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 32
British Manila rope	0 26
New Zealand hemp	0 26
Transmission rope, Manila	0 43
Cotton rope, ¼-in. and up	0 80

POLISHED DRILL ROD

Discount off list. Montreal and Toronto	net

CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Vol. XXIII., No. 13. March 25, 1920

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Are You Watching the Details of Your Business?

The Habit of Grasping Business Details is Worth Cultivating. You Pay Attention to the Details of Your Personal Life, so Why Not Do Likewise in Business Matters?

By J. H. Moore

HAVE you ever overheard a discussion regarding some executive who has reached the top of the ladder, and landed into a position of prominence? If so, you will, no doubt, have experienced surprise when you discover that the answer to his success was not so much his education, as his wonderful ability to grasp details, and make the most of them. Nine cases out of ten, it is this watching of the details, or in other words, the little things that count.

What applies to the personal side of anyone's life, likewise applies to their business. To make a success, you must pay as strict attention to the details of your business as you do to your personal matters. Only through this channel can you reach efficiency.

The points brought out are truths, met with every day, so we need not champion them, but will go on to prove by various illustrations and text, how the Willys-Overland Co., of West Toronto, have adopted certain schemes to speed up production. Schemes are nothing more or less than the outcome of thinking upon the details, wondering how to improve existing conditions, and so on. Studying detail is often described as looking for short cuts, which is a rather good way of putting it, for if, by a short cut (or quicker method, to use another expression) you can reach the same goal, then the time spent studying the detail was worth while.

The Placing of Machinery

The subject of proper placing of machinery is one that, unfortunately, does not receive the attention it deserves. It is only recently that the value of floor space has been considered. The up-to-date plant of to-day weighs carefully the question of placing equipment in their factory, not only as to position on the floor, but also on what floor (if more than one) to place it. Sequence of operations enters into the question, for maximum production demands that no lost movement be allowed.

A good plan adopted in many cases is as follows: It is first decided how the product to be manufactured will pass through the plant. This being settled, the operations are considered in proper sequence. Having decided these points, the next step is to instal the equipment best suited to the various operations. A plan view of the different floors is made, showing all windows, posts, etc. Small pieces of cardboard are now cut out, each one of such size as to represent a particular machine tool, the size cut out being the greatest possible space which the machine can occupy, with all tables, etc., out to their limit. Through each outline of a machine is placed a pin, or thumb tack.

Now commences the real task, sometimes called in the argot of the drawing office, juggling the junk around. The machines are moved to whatever position the draftsman thinks best, then the various executive heads are consulted. A regular confab takes place, machines are moved here and there, at a minute's notice. Lighting, floor space, proper drive from line shaft, etc., are all considered before the final layout is adopted, and passed upon as satisfactory. This juggling around is not accomplished in a hurry, but is carefully gone over, cussed and discussed till everyone is satisfied. The writer has had the pleasure (?) of presiding over such a board on many occasions, raising arguments and answering arguments, relative to the placing of perhaps a turret lathe or even a humble hack saw. In spite of the fact that sometimes time seems wasted in useless argument, it will always prove that every minute taken up in such discussion is time well spent. You will find that it is never necessary to alter the tool installation in any way after such a plan for all possible contingencies have been provided for.

FIG. 1—A WELL LAID OUT LINE OF MACHINERY, YET NOT RECEIVING THE BEST OF LIGHT POSSIBLE.

A Sample Installation

For purposes of illustration, let us refer to Fig. 1. In this photograph is shown a battery of Fellows' gear shapers, neatly arranged along the wall of building. The least possible floor space is occupied, and the greatest utility obtained from placing the machines in the manner shown. The question of equipment layout is one that this concern has given great thought to, the result being that to tour through their plant is a pleasure, open aisle space is assured, every machine is placed just so, in other words, each tool is laid out on the floor according to a well-thought-out plan. The attention to this one detail has saved considerable money for this concern.

To illustrate what happens when no thought is given to the placing of equipment, we quote the following story. Names are, of course, left out for obvious reasons. This million dollar concern ought to have known better, but they didn't, with the result that after installing their machinery haphazard, they found themselves, in a very short time, suffering from congestion of aisle space, and confusion of belt drives. The situation was becoming rather desperate,

FIG. 5.—STANDS SUCH AS ILLUSTRATED ALLOW THE WORKMAN TO DEVOTE ALL HIS ATTENTION TO THE ASSEMBLING OF THE AXLES.

FIG. 3—THERE IS NO QUESTION AS TO THE ADVANTAGE OF GRAVITY CONVEYORS IN CASES OF THIS KIND.

so they called in an expert to look the plant over. Reorganization of tool equipment was his verdict. He named a figure which nearly staggered them, still they realized the work must be done, besides he guaranteed results, so the deal was closed and work begun.

Machines were moved by the hundreds, but not before a definite plan was arranged upon. To make a long story short, results well repaid the firm for its efforts at improvement, for not only were the machines, operations and routing changed, but so much floor space was recovered that two new departments were added. This story gives a concrete example of the advantages derived from a careful study of this important problem.

Another detail which deserves attention is the proper handling of material between operations. Careful study of this problem makes for more adequate floor space, together with speedy handling of product. Take for example Fig. 2. This illustration depicts three crankshaft storing racks. Note the simplicity of the arrangement. Wooden pins set at an angle act as rests for each shaft. These are placed just far enough apart to allow the shafts to clear, yet no waste space is evident. The racks, or to use a better word, trucks, are mounted on four wheels, allowing easy moving from one operation to another. Schemes such as this take very little expenditure to put in operation, and save money for the firm the moment they are installed. Although we only show this particular form of truck, the plant spoken of adopts similar types on other portions of their car, each occupying as little floor space as possible, yet holding as many parts on it as practical.

The Gravity Conveyor

Gravity conveyors are used at different portions of the plant, similar to the illustration at Fig. 3. The work is much easier transferred to other succeeding operations. A good plan is to run these

FIG. 4—A SIMPLE, BUT MOST EFFICIENT TYPE OF CONVEYOR.

conveyors between two lines of machines arranging your operations to suit. In this way the workmen can place his finished product directly on to the conveyor, pushing it along to the next workman on the line, who in turn performs the succeeding operation. A conveyor such as described may seem at first a needless expenditure, but once used, will prove itself to be still another of those little details that count.

Another Style Conveyor

The next illustration, Fig. 4, is, to the reader's mind, entirely out of the ordinary run of conveyors. The number of operations through which a automobile piston must go before its completion would surprise the uninitiated. To speed up the handling between these operations, the chute illustrated was designed. It is made of ordinary flat and angle iron, being so arranged that a section stands directly at the side or rear of each machine performing an operation of the piston. Sufficient slope is placed on the chute to allow the piston to gently roll to the bottom. Each section is complete in itself, therefore the piston really enters a new chute after every operation, getting a fresh start on its journey on each occasion. The workman never needs to leave his machine in search of pistons for they are always on the job. The rough product, is of course, placed on the first chute by a workman delegated to such task. Here is another example where attention to a detail counted.

Assembling Stand

The same principle which holds good for the transferring of work applies to the assembling of the same product. If by any scheme or fixture, you can expedite the work through the plant, you are accomplishing a definite object, thereby deserving of credit for paying attention to the details.

The fixture shown at Fig. 5, represents a device used for assembling the front axle on the Overland Four car. Note that the solution was very simple, consisting of two iron stands placed on the floor, the correct distance apart, with pins on them of similar diameter to the holes in axle. By placing axle on these pins, the worker can use both hands freely, as he knows the axle is held perfectly secure by the fixture. The remaining details on this photograph are so self apparent we feel further comment is unnecesary.

As a conclusion, there is only one point to be emphasized, and that is the watching of the details. Keep an eye on the small leaks of time. Study labor motion, for there is more to such a study than some imagine. The result will well repay you for any time spent on the watching, for it is the pesky details that eat away the profits and hinder production.

Eternal vigilance is the price of liberty, so if we wish liberty from congestion, liberty from costly delays, we must keep ever vigilant, watching even the trifles which do not seem to amount to so much. Remember above all that it's the little things that count.

FIG. 2—RACKS SUCH AS THE ONES ILLUSTRATED MEAN LESS CONFUSION, MORE AVAILABLE FLOOR SPACE, AND UNINJURED WORK.

At the Broken Hill Mine in Rhodesia there exists, according to the "Mining Magazine," probably over a million tons of oxidized ores containing about 35 per cent. of zinc cum lead, which, owing to local conditions, will require special processes of treatment. It is hoped to produce a certain amount of zinc oxide for sale as a pigment. It seems probable that the electrolytic method will be preferable to distilling, as water power is available for the generation of current, and the necessary acid can be made from sulphides.

It is reported that a basin to the south of the Victoria River in the northern territory of Australia is probably the site of coal or oil deposits. The area is about 100 miles square. Its borders are on the Victoria River on the north side, with the coast on the west side, the Ord and Negri Rivers on the south side, and the dividing range on the east side. The indications of oil are reported about 20 miles south of the Victoria River. Shale that will burn is exposed on the west side. A small seam of coal outcrops on the Ord River.

Commenting on the iron smelting prospects of the Transvaal, the "South African Mining and Engineering Journal" says that an encouraging report has been received regarding a large deposit of iron ore situate about 10 miles from Navar siding on the Indwe-Maclear line. There were 1,701 tons of iron ore railed from Ermelo during the year, the bulk of it to local ore reduction plants, and a few samples to Europe. Iron ore has been found on native lands about four miles from Wolhuterskop, and ore in payable quantities is said to have been discovered in the Lydenburg district.

Among the new hydro-electric power companies, the formation of which in Japan has been hastened by the high price of coal, is one with a capital of 50 million yen, which has taken over the water power rights of three old companies. It is proposed to begin with the generation of 105,000 kilowatts, the works to be completed in two years; but eventually the output will be raised to 300,000 kilowatts. The two electric light companies of Osaka and Kyoto have agreed to take all the power they require from this new company. Another company, now amalgamated with this one, has a power house capable of generating 7,200 kilowatts, and is devoted to the manufacture of sulphate of ammonia.

Errors in Designing and Machining Bearings

The design and Operation of Journal Bearings as Presented at the Meeting of the American Society of Mechanical Engineers. This Should be of Interest to Designers in General

By C. H. BIERBAUM

IN considering the subject of bearings, their design, construction and lubrication, it is desirable to have in mind the fundamental laws relating thereto—those discovered by Tower, Thurston, Goodman, Lasche, Stribeck and others. Taking the work of these investigators in the light of what is now known concerning these laws, it follows that in the operation of a properly designed, constructed and lubricated bearing we may lay down the following ten principles:

(a) The bearing surfaces are completely separated by a film of oil.

(b) The friction of operation is the fluid friction in the oil film, and adequate thickness of film is essential.

(c) During construction proper clearance or space should be provided for a normal thickness of oil film.

(d) The advance edge of a bearing surface must be rounded or chamfered off in order to permit a supporting film of oil to form.

(e) The oil film forms most effectively upon a bearing surface, whose advance edge is at right angles to the direction of motion.

(f) An increase of speed increases the thickness of film, all other conditions remaining constant and clearance permitting.

(g) An increase in the viscosity of the oil increases the thickness of film, all other conditions remaining constant and clearance permitting.

(h) The larger the unbroken film of oil, the greater will be the average pressure-supporting capacity per unit area, other conditions remaining constant.

(i) Every unnecessary oil groove or interruption in the continuity of the oil film reduces the supporting capacity of the film.

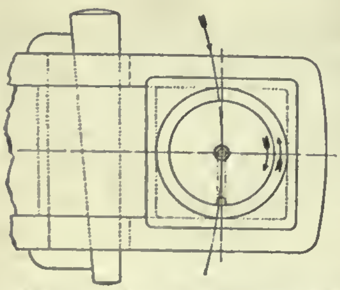


FIG. 1—PRACTICAL AND EFFICIENT METHOD OF LUBRICATING A CRANK-PIN BEARING.

(j) For every bearing condition there is a film thickness corresponding to maximum lubrication efficiency.

(2) The law governing the proper thickness of oil film has not as yet been investigated to the extent that the importance of the subject demands. In modern machinery the average thickness of film varies from 0.0002 in. to 0.006 in.

Precautions Regarding Oil Grooves

(3) Since the lubrication of every bearing is a study in itself, the application of the known laws can be discussed

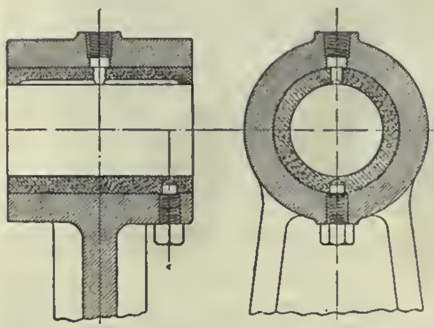


FIG. 2—TRANSVERSE AND LONGITUDINAL SECTIONS OF AN ORDINARY BUSHING DRIVEN INTO A CAST-IRON HOUSING.

to the best advantage by considering specific cases. Fig. 1 represents a theoretical ideal, as well as practical and efficient, method of lubricating a crankpin bearing, the journal receiving oil through the crankpin. The rotation of the crankshaft is in the direction indicated by the upper arrow, and in the position shown the engine is on a dead centre at a point of reversal of pressure. The direction of relative motion of the rubbing surfaces is shown by the two arrows at the right of the figure. The oil film enveloping the right half of the crankpin has been completely restored during the stroke just finished, since the oil groove passed over this half of the bearing while no pressure was being exerted upon it. After the dead centre has been passed, the entire pressure is then exerted upon the crankpin with its

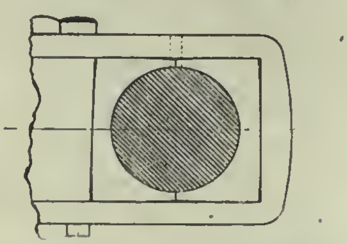


FIG. 3—PROPER METHOD OF FINISHING THE BRASSES OF A CRANK-PIN BEARING TO PROVIDE FOR NECESSARY EXPANSION IN SERVICE.

fully restored oil film, and at the same time the oil groove wipes over the other half of the bearing and restores its oil film while no pressure is being exerted upon it, after which it in turn is ready to receive a reversal of pressure upon a fully restored oil film. Thus both halves of this crankpin bearing present alternately, for the maximum pressure of each stroke, a complete and uninterrupted surface for maintaining the film on an area equal to the projected area of the crankpin, but it is impossible to obtain so perfect a condition of lubrication in a bearing having the old-fashioned cross oil grooves, which are still too often found in this class of bearing.

(4) In case the direction of rotation is to be reversed, the oil groove in Fig.

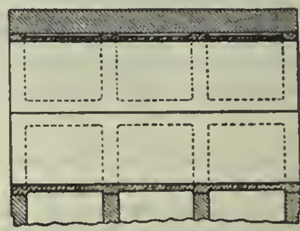


FIG. 4 — SPLIT BRONZE BUSHING OF TOO LIGHT DESIGN TO WITHSTAND THE STRESSES IMPOSED UPON IT.

1 should be placed diametrically opposite to its present position. The function of the oil grooves is, of course, that of supplying oil. In many cases they are necessary evils, which should be minimized as much as possible by avoiding a useless excess of grooves, and especially grooves in the direct line of maximum pressure of the bearing. Unless good and sufficient reason exists to the contrary, oil grooves should be cut parallel with the journal.

Disadvantages of Tight-Fitting Bushings

(5) One matter very frequently neglected, or not thoroughly understood, is that of driving in bushings. Fig. 2 shows a transverse and a longitudinal section of an ordinary bushing driven into a cast-iron housing. As all bearing alloys have a temperature coefficient of

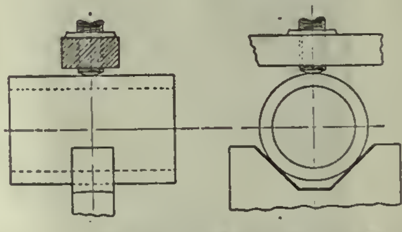


FIG. 5—IMPROPER METHOD OF CLAMPING A BUSHING FOR TOOLING.

expansion higher than that of cast iron, and as the bearing is directly subject to the friction of the journal, it follows that the bearing is at a higher temperature than the cast-iron housing and that all bearings must have an appreciable outward expansion when in operation. For this reason bushings should be driven in with just enough pressure to prevent looseness during operation.

(6) The practice of driving in bushings so tight that they require reaming before they can be put into service cannot be condemned too severely. The subsequent reaming does not remedy the evil, in that a bushing driven in so tight will and must continue to contract inwardly when in operation, since the outside pressure upon it is not removed by the reaming. In the tooling of a bearing a definite amount of clearance should be provided for, in order to insure the best service conditions. When a bushing is driven in too tight, although it has been reamed before being placed in service, the amount of clearance which it will then have becomes a matter of guesswork and the amount of oil-film space provided an uncertainty. This condition frequently gives rise to heating and bearing troubles, even though the amount of internal contraction may not be sufficient to positively grip or stop the journal. The idea that bushings must be driven in tightly in order to hold them in place is fundamentally wrong, and excessive tightness of the bushing in its housing should always be avoided. For all ordinary machinery it will suffice if a bushing may be driven in place with a blow of the hand or with a small block of wood. The provision for fastening the bushing in place should be such that it will not bind or clamp the latter against outward expansion. In the construction shown in Fig. 2 a set screw engages a hole in the bushing, but does not, however, bottom in the hole.

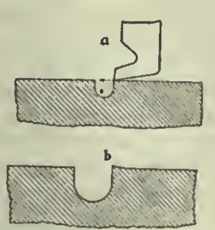


FIG. 6—SHARP EDGE PRODUCED AT THE EDGE OF AN OIL GROOVE BY AN ORDINARY TOOL.

FIG. 8—CROSS-SECTION OF THE TEETH OF A MOTOR TRUCK DRIVE WORM WHEEL.

Proper Method of Finishing a Crankpin Bearing

(7) The finishing of bearings in such a manner that they may expand while warming up is of very considerable importance, and this can be done in many cases by simply giving the matter the full consideration which it deserves.

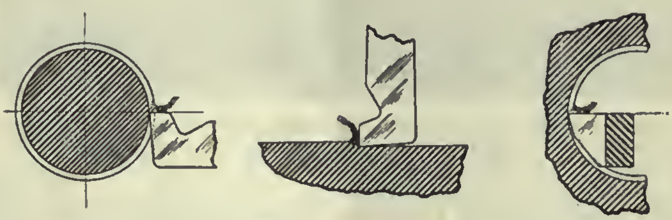


FIG. 7—IMPROPER FORMS OF LATHE, PLANER AND BORING TOOLS.

Fig. 3 shows a crankpin bearing finished in a manner providing for necessary expansion in service. The two edges of the two half-bearings should be "brass bound," that is, they should bear solidly against each other and should exert a pressure against each other somewhat in excess of the maximum crankpin load. The outer surfaces of both bearings near these edges should be relieved so as not to bear upon the straps, as shown, somewhat exaggerated, in Fig. 3. The four corners of the bearings should be relieved in like manner so that the horizontal thrust will be mainly borne upon the surfaces falling within the area of the horizontal projection of the crankpin. A bearing thus constructed expands with the first slight increase of temperature, relieving the crankpin instead of clamping it as when these precautions are not taken.

Designing for Strength Important

(8) The matter of proper design of bearings as to strength is likewise of importance. Fig. 4 shows a bearing put in service by one of the oldest-established machine builders and which gave very considerable trouble. It is a split bronze bushing 12 in. long, supporting a journal 6 in. in diameter; the maximum thickness of the bushing was ⅜ in. and it was recessed on its back to a depth of ⅛ in. as shown, leaving a thickness for the larger part of the bearing of only ¼ in. The cap of the bearing was held down by ten ⅝-in. studs. Now it is obvious that by clamping this bearing the bearing surfaces were materially distorted by the pressure consequent on the tightening of the ten nuts. It is also apparent that the thickness of the recessed and unsupported part of the shell was not sufficient to withstand distortion under a fluid film pressure such as would normally be exerted upon it. The trouble with this bearing was therefore due entirely to the fact that it was too light á design.

(9) Mention may here be made of another class of bearings, which, together with their supports, are often improperly designed, namely, self-oiling ring bushings. These are nearly cut in half at mid-length in order to provide space in which the ring may operate, and the supporting wall beneath the bushing is slotted correspondingly at the centre to permit the insertion of the ring into the oil well. This often unduly weakens the bearing at a point where normally the greatest film pressure is exerted. In general, much of the trouble at present encountered in bearings can be overcome by simply increasing the strength and rigidity of the bearings and their supports, since an insensible amount of distortion and deflection is sufficient to produce all manner of annoyances.

Bearings Should Be Clamped Endwise For Tooling

(10) Another matter very often overlooked is that of the manner in which bushings or bearings in general are clamped during tooling. Fig. 5 shows end and longitudinal views of an improperly clamped bushing. With a ⅝-in. 16-thread set screw and the application of, say, a 50-lb. pull upon a 12-in. monkey wrench, a pressure of 50,000 lb., can be carelessly exerted upon the bushing in question, and it must be remembered that the composition of a bearing material is never one that would be selected for maximum strength. Bushings tooled when clamped

FIG. 9—PHOTOMICROGRAPH OF FIELD AT G, FIG. 8 (60 MAGNIFICATIONS), SHOWING DISTURBANCE OF CRYSTALLINE STRUCTURE DUE TO THE USE OF A DULL HOBB IN TOOLING.

FIG. 10—PORTION OF FIG. 9—MORE HIGHLY MAGNIFIED (120 MAGNIFICATIONS) SHOWING CLEARLY THE COLD ROLLED EFFECT ON THE BEARING SURFACE OF THE TOOTH.

in the manner shown in Fig. 6 seldom have a bore that even approaches a true cylindrical surface, and if they are then driven upon an arbor and finished on the outside a very inaccurate product is the result, a bushing that can never give the most satisfactory service. The best and most satisfactory method of holding bushings for tooling is that of clamping them endwise. The importance of this is very generally underestimated; in general, bearings should be held in a manner such as to produce the least possible amount of strain and distortion.

Chamfering the Edges of Oil Grooves

(11) The matter of chamfering oil-groove edges deserves special attention in that all advance edges of a bearing should be rounded and chamfered off, and the fact that this work should be done last, after all of the other tooling of the bearing has been completed, is important. At a, in Fig. 6, is shown an ordinary lathe tool at the edge of a groove on a finished surface. It is obvious that there are being exerted two forces upon any surface which is being tooled, one horizontal or parallel to the finished surface and the other vertical or in a direction normal to that surface. The resultant of these two forces is a force indicated by the dotted arrow, in a direction tending to deflect the edge of the groove obliquely downward, producing an effect which is shown somewhat exaggerated at b, Fig. 6. It can readily be appreciated what an injurious effect is produced in a bearing if any tooling is done after the oil grooves have been cut, especially so if the direction of rotation of the journal is opposite to that of the tooling. In all cases sharp edges of the groove prevent the formation of an adequate oil film and should be carefully avoided.

Why Bearing Surfaces Should Be Machined With Sharp Tools

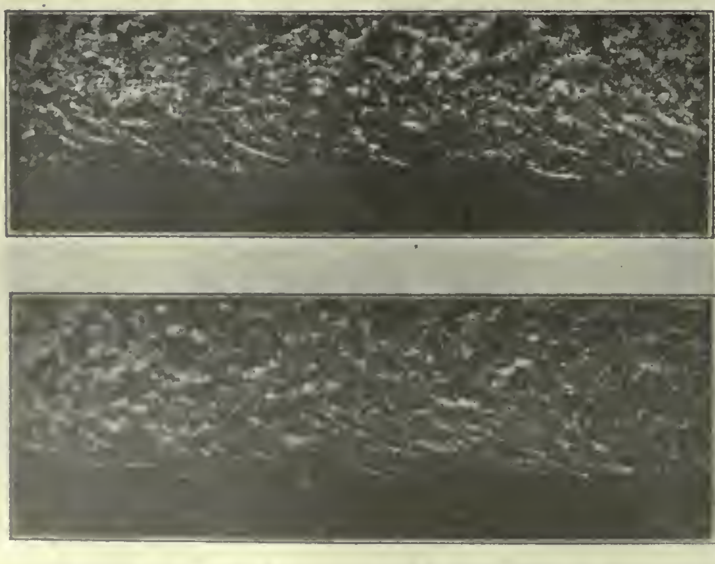
(12) For best results it is very necessary and it is also general practice that a cutting tool should have rake. The tools shown in Fig. 7 would be readily condemned even by a person with a very limited shop experience, and no journeyman machinist would think of setting a lathe tool as shown at a, a planer as at b, or a boring tool as at c. In the last mentioned case the amount of normal or radial pressure which it exerts upon the finished surfaces is far in excess of what is necessary. Consider now the standard multiple-cutting-edge reamer which is very often used in finishing bearings. A 2½ in. reamer would have, say, 14 edges, and the amount of bursting or internal pressure that it would exert within a bushing would be at least 14 times that exerted in case the bushing were reamed with only one improper tool, as shown at c, Fig. 7. This practice is one that cannot be condemned too severely.

(13) The final finishing in bearings should be done by reamers or cutting heads having only one or a very limited number of cutting edges, and these cutting edges should have the proper amount of rake—such as would be given to any other proper cutting tool. Experiments made in a large manufacturing plant on bushings of the same dimensions, from the same lot of material, finished at the same time, some, however, being reamed with the standard multiple-cutting-edge reamer, and others with a single cutting blade, showed that, after a storage of six months, those bushings which had been reamed with a proper single cutting edge retained their accuracy and shape much better than those finished with the so-called standard reamer. The latter bushings exhibited a decided tendency to decrease in inside diameter, and to assume inaccurate, elliptical forms. It was also brought out at this time, that not only did a superior product result from the use of a proper tool, but that, by its use, the production could be increased from 15 to 20 per cent.

FG. 11—PHOTOMICROGRAPH OF EDGE 6, FIG. 8 (96 MAGNIFICATIONS). SHOWING THAT A SHARP TOOL WITH SUFFICIENT RAKE WILL NOT DISTURB CRYSTALLINE STRUCTURE.

Defects in Bearing Surfaces Revealed by the Microscope

(14) Another reason why bearing surfaces should be tooled with sharp tools having the proper amount of rake is brought out by a microscopic study of bearing surfaces. In order to obtain the full value of bearing alloys, it is necessary that these alloys should be presented as bearing surfaces having their natural crystallization undisturbed. The reason for this is given in the report of the Society's Research Sub-Committee on Bearing Metals. The hard or bear-



FIGS. 12 AND 13—PHOTOMICROGRAPHS OF THE INNER EDGE OF A BUSHING FINISHED WITH A DULL BROACH (60 MAGNIFICATIONS), SHOWING MUTILATION OF THE SURFACE MATERIAL.

ing crystals should be embedded in a softer material, permitting the former to adapt themselves to the journal surface. The softer crystals, under proper service conditions, will wear slightly below the surface of the harder crystals. In order to retain these conditions, it is necessary to preserve the natural crystallization upon the bearing surfaces; but this cannot obtain where they have been mutilated by improper tooling. This mutilation of the bearing surfaces gives rise to the crushing of the harder crystals, and embeds these crushed particles into a compressed material which does not function as a normal bearing alloy.

(15) A very forcible illustration of this is furnished by the bronze worm wheel of a certain motor-truck drive in which the teeth had been finished with a dull hob, Fig. 8, showing a cross-section of one of the teeth. After giving unsatisfactory service, the worm wheel was examined in the usual way by chemical and physical tests, neither of which showed any defect whatsoever. On the other hand, microscopic examination showed that the trouble was due to improper tooling. Fig. 9 shows a photomicrographic section of a field at a, Fig. 8. This view clearly shows that the natural crystallization of the greater part of the arena has been disturbed, and that the edge of the tooth has had a cold-rolled or wire-drawn effect produced upon it by improper tooling. It is true this effect is not very deep; nevertheless, it is on the very surface which is brought into play when the worm wheel is put into operation. Fig. 10 shows a part of Fig. 9 more highly magnified, in which the cold-rolled effect upon the surface is seen to be even more complete, a condition which proved to be the sole cause for the very unsatisfactory performance which this wheel gave in service. Fig. 11 shows a magnification of part of the edge b of Fig. 8, the inner edge or surface of this wheel from which it is centred accurately to within a thousandth of an inch upon its spider. This surface had been tooled in a horizontal boring mill with a single cut, the tool set so as to produce a smooth finished surface. The cutting of this surface, however, was done with a tool that was sharp and had sufficient rake, showing that it is an easy matter to cut a bronze surface satisfactorily without distorting the natural orientation of its crystalline structure.

(16) Figs. 12 and 13 are photomicrographic sections of the inner edges of a bronze bushing which had been finished or tooled by broaching with a dull broach. These micrographs distinctly show what not to do; they show that the surface material has been distinctly mutilated, and that the compression of the material upon the bearing surface is very uneven; and they prove, conclusive- to best service requirements.

PREHEATING CAST IRON

Preheating cast iron should be done slowly but thoroughly. There is great danger of warping or cracking a thin iron casting by improper preheating in an open fire. It is advisable, whenever possible, to interpose a steel sheet between the part to be preheated and the direct flame. The time required for heating will be increased, it is true, but the danger of excessive unequal expansion and overheating will be eliminated. The top of a stove is an ideal place for preheating small parts. The heat obtained with a hot fire is sufficient for all general preheating requirements, and there is no danger of overheating.

The uses that can be made of the oxy-acetylene torch are without limit and new ones are discovered every day. The possibility of quickly restoring a broken part to use often means saving many times the cost of the part. It is not the cost of the thing that counts so much as the want of it. If a machine or department is held up, and work is waiting for a new part to come from the factory, the loss may run into hundreds or thousands of dollars. What, then, is the value of a repair apparatus which, in the hands of a skilled operator, will make the broken part as good as new in an hour or so? It is simply incalculable.

The parts of machines are united by screws, bolts, and rivets. Screws and bolts are necessary in many places in order that the parts may be separated when changes or repairs are required, but in many cases screw connections are used which are practically permanent, after being once assembled, as they are never separated when disassembling the machine for repairs. Such parts, of course, might as well be welded together as screwed. Often there will be a distinct gain in strength, simplicity and appearance. There is also a gain often in cost of fitting.—"Welding Engineer."

DEVELOPMENT OF COAL AND IRON RESOURCES

THE "Monthly Bulletin" of the British Chamber of Commerce in Brazil (Rio de Janeiro) states that public interest continues to be largely directed to the development of the coal and iron resources of the country. In the State of Minàs the President and Legislature have been occupied with a Bill designed to promote more rapid development of the mining projects in the rich iron region embracing a considerable part of the Cordilheira do Espinhoso. The Itabira Iron Ore Co. reports that prospecting in Conceicao has led to the discovery of hard mineral eminently suitable for export in Europe, and that thus 50,000,000 tons of high grade mineral have been added to the estimate of the productivity of the company's mines. It is considered that as soon as export can be established there will be a great demand for the mineral for the purpose of the British iron and steel industry—the quality of the Itabira ore being excellent and calculated to supply the present shortage of non-phosphoric mineral of high grade.

A complete study of the facts up to date is furnished by Snr. Elysio de Corvalho in his publication "Brazil as a World of Power," in which he regards the establishment of a national iron and steel industry as the key to the solution of Brazilian economic problems and even political destinies. The fabulous mineral deposits of Brazil only await capital and energy to place her in a position of exceptional eminence on her side of the Atlantic. Snr. Corvalho considers that the prospects of the national industry are not dependent either on the national coal or imported coke, but that smelting may be well established either by high furnaces fed by charcoal, which Brazilian forest reserves can supply or by electricity processes for which many sources of water power on a great scale furnish ample scope. The Government have already legislated for the financing of such national enterprises, but the initial difficulties in the way of a rapid development of an iron industry in Brazil remain the same. Among others there is that of transport, and the question is not merely one of building railways. The general level of cost in the country has been so raised that in normal times nothing short of a practical prohibition of importation can enable Brazilian home manufacturers of many kinds to compete. During the war, when many articles could not be imported, a number of national industries sprang into being, and as regards iron and metal goods many articles, including machinery parts, were made locally to fill the place of what could not be imported.

The importance of Brazil's iron resources, however, does not lie in local industries for home supply; it lies in the export of ore or of metal. If the ore can be reduced to metal at a low cost in Brazil, then millions of tons are made available for European and other markets. If, on the other hand, the ore has to be exported, the cost of rail and rolling stock, besides freight for the ore in bulk, must continue to weigh heavily against Brazilian export.

For the time being, therefore, Brazil is only a potential seller of iron ore on a great scale, and must continue to import iron and steel materials and manufacturers. The United States has been the chief source of supply during the years of shortage, and it now lies with other iron and steel exporting countries to regain their footing as far as they can.

The Rickert-Shafer Co., of Erie, Pa., manufacturing the Boehm Automatic Die Heads and the Rickert-Shafer line of Automatic Tapping Machines, are announcing recent appointments in their organization, as follows: A. A. Shafer, secretary and general manager; C. W. Howard, formerly with the General Electric Co., general sales manager: A. J. Patterson, formerly with the Crucible Steel Co., general superintendent; Geo. Paterson, production manager.

Reclaiming and Using Broken High Speed Tools

The Possibility of Saving Money in This Way Has Been Overlooked by Many Concerns. A Furnace is Herein Described and the Method of Its Use is Also Given

By JOHN A. HOPE

RECLAIMING and profitably using up broken parts of high speed steel cutting tools is a proposition that is never entirely overlooked by the management of any progressive manufacturing plant. The alternative to melting and recasting into ingot form this high-speed steel scrap which cannot be otherwise profitably used is to sell or dispose of it to those people who are especially interested in the steel industry or manufacture.

There are only two firms that I know of that are successfully remelting high-speed scrap in Canada on a miniature scale. The perspective drawing herewith is a design that I have installed and worked successfully in reclaiming this steel.

It is necessary before going into melting detail, to consider what portion of high-speed steel would be recommended as purely scrap before setting it aside for melting.

The process of (Tip-It) welding tips on cutting tools, where the body of tool is low carbon steel, has proved, in most shops where this process has been used, that small selected pieces of high-speed steel, which previous to the war were regarded as scrap, became very valuable when applied as tool tips. Large sections of broken cutting tools can also be profitably drawn and hammered into suitable flat milling cutters, etc.

The high-speed steel that would be classed as remelting material would come under the heading of all such broken spiral milling cutters, milled or twisted drills, special broken-toothed form cutters, broken hollow mills, or any high-speed steel with holes or inserts that will not lend itself to be hammered or drawn, high-speed steel cuttings included. Now with our material ready for remelting, we come to the furnace arrangement.

Furnace Shell Construction

Procure second-hand tank plate, either ⅜ or ½ in. thickness with a proportionate amount of 2 in. angle iron to bolt up sides, ends and bottom; this to complete a shell for bricking 8 ft. x 3 ft. x 3 ft. 10½ in. height; rough punch a 3 in. diam. hole at one end of box, approx. 8 in. from top of this box where marked "flare" in perspective. This is the fuel oil burner opening.

This furnace should be preferably located in a grey iron or steel foundry would ensure economic operation in respect to use of foundry man when high-speed steel melting would be required, as this melting would only be required at stated times when scrap accumulation was available.

In any case, wherever it may be decided to locate this furnace, excavate large enough space to sink shell of furnace in ground to level as marked up in perspective. Fill dry sand in around shell of furnace to floor level, allowing for a small concrete box opening at burner end of furnace 18 in. x 18 in. x 16 in. deep to give ample room for entrance of 6 in. blast pipe and burner.

Furnace Bricking

The next step is to fill in furnace shell with approx. 2 ft. depth of dry sand, and apply two layers of fire bricks to form floor of furnace. The usual mode of furnace bricking will now be followed throughout. When completed, it will have finished chamber 5 ft. 6 in. long by 1 ft. deep, the extra height of crucible clearance being obtained in the square built-up section on which furnace cover rests as shown in perspective.

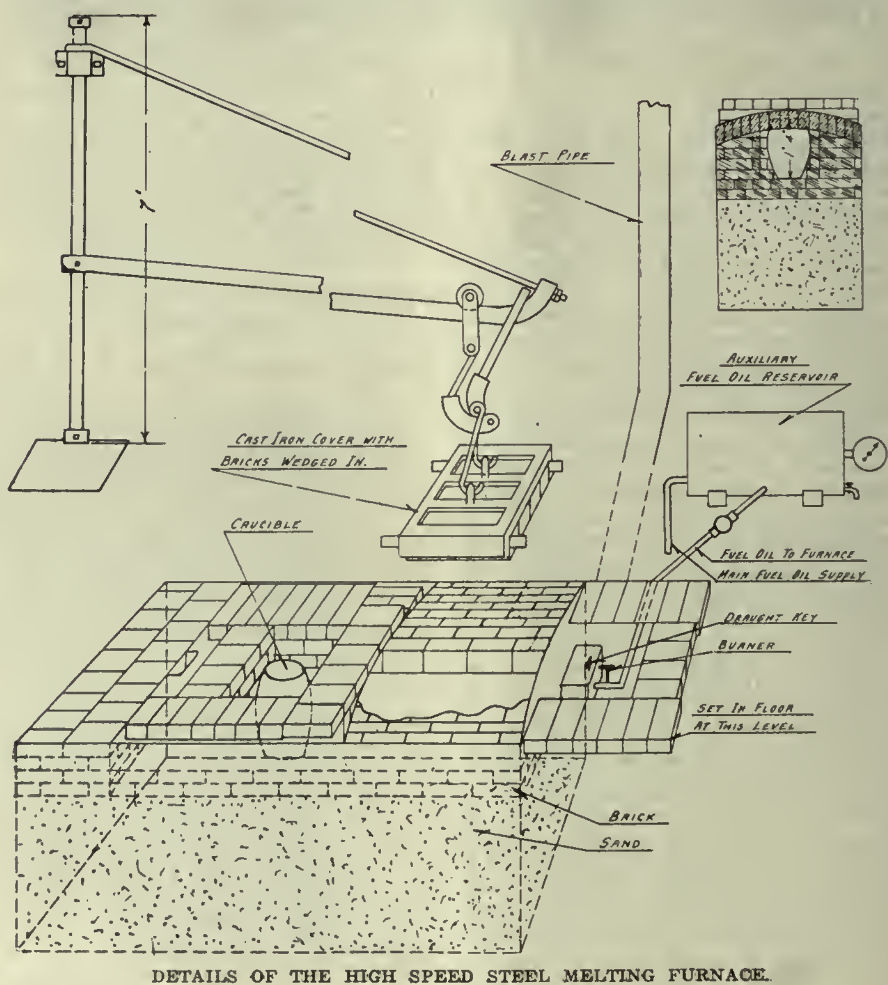
It is necessary to make a gradual sweep from floor of furnace to gas vent in order to avoid flame checking on flat surface at rear end of furnace when being lit up; also to observe flare in bricking at burner entrance to let combustion spread well.

Too much care cannot be given to selection of good fire brick and to using a very light wash of hytempite or other temperature cement rating to stand approx. 3,000 deg. Fahr.

The time expended in carefully keying the brickwork in this small furnace will give very satisfactory returns. If too much cement is used with poorly fitted arch-bricking, the whole will collapse and cave in in less than five or six heat charges. The same applies to the furnace cover. Brick should be carefully keyed in providing a 1 in. test hole in cover centre for rod.

Fuel Oil and Combustion

It is to be noted that this furnace construction is arranged for crude oil operation, and it is necessary to use a crude oil burner of the low pressure type. In experimenting with several of these burners, the Jacobs low pressure burner seemed the best adapted to this design of furnace. It has been successfully used to melt high-speed steel, and is mentioned only to give readers an ap-



DETAILS OF THE HIGH SPEED STEEL MELTING FURNACE.

proximate idea of the class of burner necessary.

Blast and Fuel Oil Arrangement

Burner being fastened central over the orifice before-mentioned, the blast pipe connection is then made, care being taken to have no extreme right angle connections in blast pipe leading from blower to burner. Steel pressure blower of one of the standard make with a 5 in. to 6 in. discharge, and speeded up to indicate 8 to 9 oz. pressure entering furnace is necessary.

It is very desirable to operate this blower independent of other furnace connections, for unless there is a generous excess of oz. pressure to spare the operating of other furnaces will cause an intermittent and varying pressure and give unsatisfactory results. Fuel oil pressure, which is generally pumped to shop lines in pressures varying from 50 to 100 lbs., is quite satisfactory in this pressure range.

I would recommend the use of an auxiliary reservoir as per perspective main oil line being connected to same and oil pipe from reservoir connected to burner. Use of reservoir is advisable for several reasons. First, in diminishing the irregular pumping throbs that cause a noticeable unevenness in furnace combustion. Secondly, it gives better accommodation for applying fuel oil strainer—gauge, drain cock and cut-out valve.

The standard ¼ in. needle valve is recommended as oil regulator, and is placed close to burner with not more than 1/16 orifice opening in seat. It would be necessary where oil pumped pressure is not available to pipe compressed air to this oil reservoir to maintain a pressure on oil of at least 50 lbs., taking care to drain off water from time to time due to condensation. This arrangement will give good, satisfactory results but is more troublesome on account of having to regularly recharge fuel oil reservoir.

Crucible and Moulds

The next care is to procure a good, high heat resisting crucible. The dimensions of same are given in perspective.

The depreciation in crucibles is set up from the interior, a 1/16 layer coming away in scale at each heat. This is the maximum. Crucibles should be kept for a few days on the roof of some slow heat furnace, not subject to assimilating any contacting moisture.

I might say that having placed two of these crucibles on a small core rack in core drying oven, as an ideal spot to keep them well baked, I discovered in the loss of them that a large core being placed adjacent to them transmitted enough moisture to make them defective.

It is also advisable when crucible heat is poured to have another steel-charged crucible sitting on furnace roof to take the next heat, returning used crucible in its place to slowly contract, not putting any steel into it at the time on account of varying temperatures of pot and steel. If crucible is not to be used after the first heat and no second heat to be run, it is best to return it to furnace for gradual cooling down.

The ingot or pouring moulds are fairly produced to suit the needed size of ingots required for particular work. The standard for this miniature process would be made of cast iron.

Procure several cast iron bushes, 10 in. long, 4 in. o.d., and bore taper inside one end 3 in. to 2½ in. at the other end, face of large end, and this completes the regular moulds required for general purposes. Note carefully that inside bore of moulds has no blow holes and machine is smooth, as it is important to produce a nice, smooth ingot, for if this is not given attention, any extreme pitting or seams in ingot will develop trouble when being drawn out under hammer.

Keep moulds on top of furnace to within a few minutes' time of drawing out heat, also a small cast iron even-surfaced plate. Previous to pouring, place plate on a previously determined ground position and lightly dust some fine sand on face, then place row of heated moulds large end down in a row on plate and the sand will seal bottom end securely.

Be careful to pour in exact centre of mould. Note this is where foundry moulder is preferred. Hot metal must not splash the sides of mould, and a novice will invariably do this, causing seams, blow holes, etc.

Drawing Out Ingots

Directly ingots are mould cast, remove ingots and as it is not preferable to draw them out at this time place them in a box of dry lime and cover up.

When entirely cooled down, remove them and examine if piped. With the best of care this trouble will exist in centre but not as a rule to an extended depth. By using a cope or head to feed the core shrinkage, this can be practically eliminated. In just filling the mould, when drawing the ingot under hammer, retain this pipe end in tongs, and when drawn out to desired length this end is cut off and returned for remelting.

Best results in hammer drawing out are obtained by preheating or soaking in a coke oven to ensure entire heat through centre. Ingot can then be brought up to a good working heat in fuel oil furnace and quickly hammer drawn under good, smooth-faced hammer blocks.

Several hundred feet of ⅜ in. x 1½ in. high-speed steel cutters, drawn in the manner described, gave satisfactory service. Note.—To freely machine this steel when drawn out, all that is necessary to do is seal up large quantity in cast iron box with powdered charcoal, place in muffle gas furnace and carry out standard annealing practice.

Procedure in Melting

First.—When in the case of newly constructed furnace, thoroughly bake and dry out. Don't force heat.

Second.—Fill crucible with scrap high-speed steel, preferably placing light material and cuttings at bottom.

Third.—Place crucible in place in furnace with an outside closing pair of double-handled tongs, closing tongs when closed on crucible to form a ring just below crucible centre.

Fourth.—Swing furnace cover in place and lower down, making sure that test hole in furnace cover is relative to centre of crucible.

Fifth.—Apply fuel oil and blast to furnace. Blast on fuel and with enough oil to prevent smoke, gradually increase flow of oil, after period of approximate 20 minutes, and as the heat units increase a soft gradual increasing temperature will build up, showing very little flame from gas vent, and in the course of 1¾ hours will be down to melt.

Sixth.—Use a ⅜ round testing rod dipped in graphite and tap into crucible through hole in furnace cover. Note crust forms on the top of melt and rod will pierce through by applying a little pressure. Drawing test rod sharply out will indicate fluid condition.

Seventh. — When considered ready to pour, quick work is essential. Moulds ready. Tongs handy to lift out crucible and place in pouring tongs, pull slag off top and pour quickly.

Other Useful Information

In checking up the analysis of this recast high-speed steel, it will be found that it is necessary to add hardening contents. At the time crucible has just been drawn from furnace and slag top removed, add 1 per cent. of ferro manganese and half of 1 per cent. ferro chromium, and stirring quickly before pouring will be found to give good cutting per cent.

The Thermit Supply Co., New York, supply this material. To know that furnace is giving correct results, removal of cover should disclose interior appearance known as snowball heat and the outline of crucible is hardly distinguishable without smoked glasses.

Cost Data

Crucible do Crucible Fuel oil cost Labor do Drawing out do	} = 16c per lb. of H. S. Steel Cast
Overhead charges, 100%	= 16c per lb. of H. S. Steel Cast
Value of scrap H. Speed Steel at	19c per lb.
Equals	51c per lb. cost of reclaim

Reclaimed by this method from scrap to machine use again.

Three heats per nine-hour day can be easily accomplished, average 75 lbs. each heat, making this reclaim a profitable investment for individual shops having high-speed steel scrap accumulations.

According to the Government "Gazette" of Madagascar a scheme has been approved for a hydro-electric installation at Tamatave. The waterfalls are situated 10 to 15 miles west of Tamatave, on the Ivondrono River, and are estimated to be capable of producing 3,000 horse-power. The water power will be available to furnish power in connection with the electrification of the railway from Tananarive to Tamatave, a distance of 229 miles.

Are Your Planers Fitted With Cast Iron Pulleys?

If So, Read This Article. The Ford-Smith Machine Co., Hamilton, Canada, Took the Trouble to Change Over From Cast Iron to Aluminum Pulleys With Surprising Results

By J. H. MOORE

IT is perhaps not as well known as it should be, that the up-to-date planer of to-day is equipped with aluminum pulleys in place of the regular cast iron variety. In conversation with an honest-to-goodness mechanic the other day, the writer mentioned this fact, when, imagine his surprise to hear the party concerned reply, "Well, do you know, between ourselves, that's the first time I knew they had made any change? Why did they make it? What advantage has it over the old style, except perhaps being a little lighter in weight.?"

After explaining the advisability of the change, the idea of an article on the subject suggested itself, so this information to follow will not be constructed on mere theoretical fancies but chuck full of facts and figures.

After deciding on the preparation of such an article, the next step was to secure some actual example showing the advantage of such a change. Upon investigation the writer found that the Ford-Smith Machine Co., Ltd., of Hamilton, Canada, had tried the scheme with great success, so that the article to follow is produced through the courtesy of this company. As Mr. Ford-Smith, the manager of this wide-awake concern, mentioned to the writer: "We tried the scheme for two reasons, first, because we believed in it, and second, because it is absolutely imperative that we get the maximum efficiency out of our planers in order to produce millers that will keep up to our present standard.

"The information and figures we have proved by these tests are yours for the taking, because it is our belief that discoveries such as this should be made public in order to help others in like difficulty."

Having thus explained the origin of the article, and how the idea first came into eing, let us enter into the technical detaails of the matter itself.

No doubt readers already know that the pulleys we have in mind are the two pulleys operating the table of the planer. One pulley drives the table in one direction while the other pulley reverses the direction of motion. Each of these pulleys attain quite a speed, of course creating considerable kinetic energy. The time comes to reverse the motion of table, and over goes the belt. The usual result is a horrible squeak, owing to the slip existing between the belt and pulley. The reason is apparent. The weight of the grey iron pulley is so great that it is really stronger than the power exerted by the belt, the result being that it is some considerable time before the speed and motion of the pulley is arrested.

This slip, creep, or whatever you like to call it, means loss of motion, loss of time, not to speak of the continual squeak. It also means that the cutting tool must be set ahead of the work so as to allow for this creep, in other words a longer stroke is necessary than otherwise would, were the reversal of stroke be dependable.

As all these points are big factors in production, it is not surprising that planer manufacturers attacked this problem earnestly in order to overcome the bugbear, or that the Ford-Smith Machine Co., Ltd., decided to likewise get the time-killer by the throat, so to speak.

Six planers were used as a test basis, these being of the following makes and sizes: One Butler 26-in.; two Bertram 26-in.; one London Machine Tool Co., and two Bertram 36-in.

Every point was watched carefully in the test even to the cost of the aluminum pulleys installed, and we have arranged for the reader's benefit, this matter in tabulated form. It might be well to add that this table is something worth clipping out for future reference.

Assuming that the average stroke used on planer work is 3 feet long, and that 35 per cent. of the total working hours are used in setting up work, grinding tools, etc., the saving in one year of 50 working weeks would be (with planers rated at $2 per hour) as follows:

The average increase on the 3-ft. stroke is about 14 per cent. One week's work equals 48 hours. Taking off the percentage for setting up, grinding tools, etc., the actual cutting time on each planer would be only 32 hours. This means that the cutting time saved on each planer would be 14 per cent. of 32 hours, which equals 2.75 hours.

As you however save at least 7½ per cent. by the adoption of aluminum pulleys in the shorter stroke possible, we can safely add this amount, bringing the total number of hours saved on each planer to 3.8 hours per week. This means that the cutting time saved by the six machines on test would be 6 x 3.8 x 50 in one year. In dollars and cents (remembering that the basis of cost is $2 per hour on all sizes of planers) we get the following staggering total of $1,240.

In other word $1,240 was being wasted

Test Record	One Ft. Stroke			Two Ft. Stroke			Four Ft. Stroke		
Name, and Size of Planer	Reversals per Minute		Per Cent Increase	Reversals per Minute		Per Cent Increase	Reversals per Minute		Per Cent Increase
	C. I. Pulleys	Alumin Pulleys		C. I. Pulleys	Alumin. Pulleys		C. I. Pulleys	Alumin. Pulleys	
Butler-26"	24	30	25%	15	17	13.3%	8½	10	18%
(2) Bertram 24"	26	30	15.4%	14½	16	11%	8¼	9	9%
London Mch. Tl. 36"	18	21	16.6%	12	14	16.6%	7½	8	7%
(2) Bertram 36"	16¼	20	23%	10¾	13	21%	6½	7	8%

THIS TABLE ILLUSTRATES RESULTS WELL WORTHY OF CAREFUL CONSIDERATION.

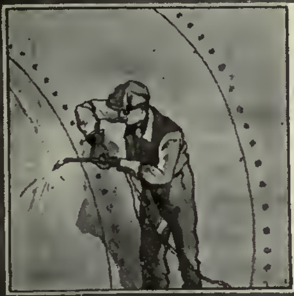
every year on these six planers. Suppose a plant is equipped with twenty or thirty planers, imagine the real money that is going to waste through lack of consideration of this point.

The costs of the pulleys for all six planers, including pattern costs, was only $300.

As a conclusion, suppose we view the advantages derived and how the results were so satisfactory. First, they have no belt slip, as the pulleys reverse instantly. This, of course eliminates squeaks, giving more strokes per minute. They also shorten the stroke to just clear the work, for the travel of table is so dependable as to allow their doing so. Belt troubles are a thing of the past, for there is no undue strain exerted on the belts as previously existed.

The reason for these improvements are no doubt already apparent to every reader. The aluminum pulley being so much lighter it cannot store such a large amount of kinetic energy, therefore is easier arrested in its speed. The belt in this way has an easier task, for in place of the preponderance of power being in the pulley the balance of power is in favor of the belt. This guarantees immediate reversal of motion without the attendant squeak.

To every manufacturer reading this article we suggest they consider this problem carefully. These figures given are authentic and definite, not mere theories, so that by installing aluminum pulleys on their already existing cast iron equipped planers they will be plugging a dangerous leak and adding more money in their pocket besides increasing the productive qualities of their machines.



WELDING AND CUTTING

Considerations in Welding of Malleable Iron

This Article, Which Appeared in the "Welding Engineer," Discusses Various Points of Interest

By H. A. SCHWARTZ

UNLIKE most other cast materials, malleable iron possesses its characteristics not only on account of its compositions, but also on account of heat treatment to which the castings are subjected in the process of manufacture.

As originally cast, this material is hard and brittle, and has a white fracture. Its appearance under the microscope is indicated in Figure 1. In this figure the white ingredient is iron carbide (Fe3C), the greyish background being a solid solution of this carbide in iron. All carbon present is in the combined form.

In the annealing operation the appearance and structure of the hard iron is entirely changed, the resulting product being resistant to blows under the hammer, and of a black velvety or grey silky fracture.

Under the microscope malleable iron has the appearance as shown under Figure 2 in which the rounded dark areas are free carbon in the "temper" form, the white background being a mass of nearly pure iron in the form of separate grains. The latter structure is derived from the former by the heat treatment to which the metal is subjected in the annealing. This heat treatment, in general, consists of raising the temperature of the product to somewhere between 1,500° and 1,700° F., maintaining this

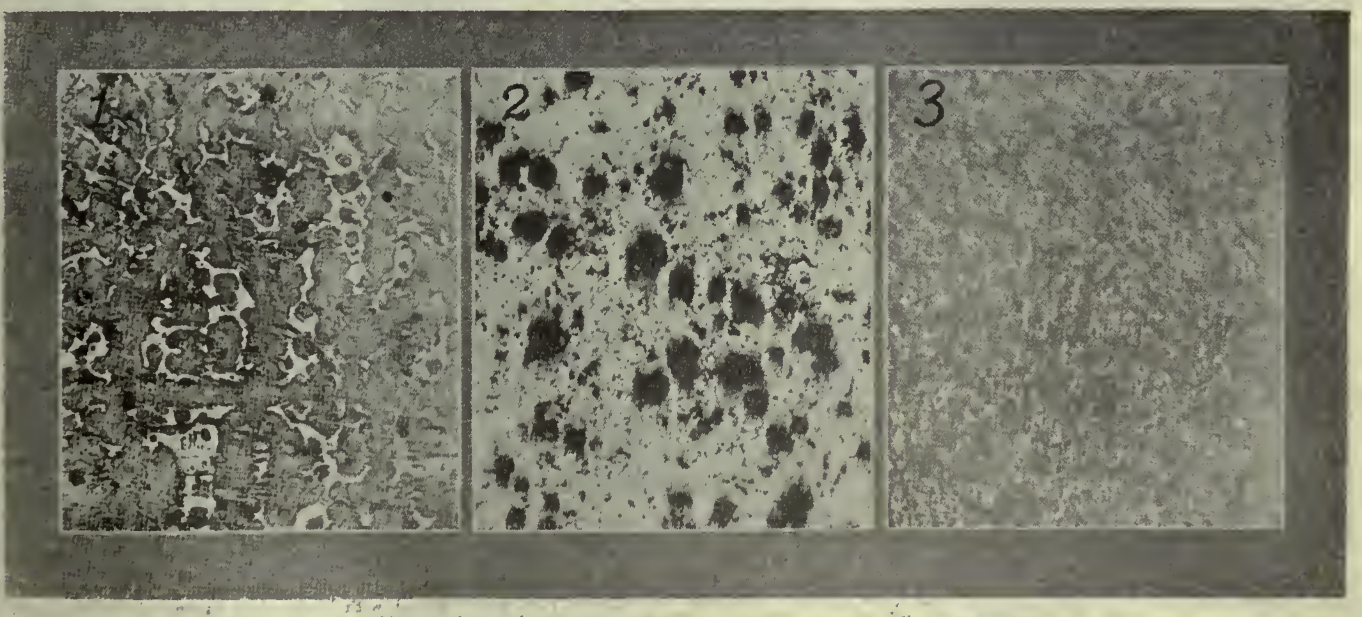


Fig. 1—White Cast Iron (Unannealed Malleable). Etched with Nitric Acid magnified 60 diameters.
Fig. 2—Malleable Cast Iron. Etched with Nitric Acid magnified 60 diameters.
Fig. 3—Malleable filler welded into Malleable Casting showing filler material only. Etched with Nitric Acid magnified 60 diameters.

temperature for a period from ten to forty hours, and then allowing the casting to cool very slowly, usually at a rate not more than 10 an hour. The exact time and temperature vary somewhat in different plants, and under different circumstances.

If malleable iron is heated to a temperature above the critical point (Ac1), all, or part of the effect of the annealing is destroyed, depending upon how high a temperature the material has attained. Such reheating unless followed by cooling at least as slowly as is the practice in the original annealing will cause the casting to again become hard and brittle, approximating in character, at least to some degree, the properties of the original hard iron casting.

The welding of this material involves, necessarily, the heating of a part of the article to be welded to a temperature up to its melting point, and is, therefore, accomplished with greater difficulty than will be found in the welding of any other similar product. Generally speaking it is the practice to weld a material, using as a filler a material as nearly identical with that of the article to be welded as may be possible.

In Figure 3 is shown a microphotograph illustrating what happens when an attempt is made to repair a malleable casting by welding malleable iron into the section to be repaired. The photograph represents a section of the weld corresponding to the material derived from the molten filler rod. This section instead of having the structure normal to malleable iron as shown in Figure 2, has a micro-structure differing from that of hard iron shown in Figure 1, only in that it is finer grained. In other words in the process of melting, all of the temper carbon of the malleable iron has been reconverted into the combined condition in which it existed in the original hard iron casting. The structure is close grained merely because the small weld freezes more quickly than a fair sized casting. The material in the weld has the properties one might expect from the micro-structure, in that it is as hard and brittle as the un-annealed casting, therefore, this method of procedure is a total failure.

It may be argued that since the body of a malleable casting consists mainly of nearly pure iron, a weld might be made using Armco iron, or a Swedish wrought iron for the filler.

Figure 4 is a microphotograph of the material filled into a weld, using Armco iron. It will be seen that this structure has not the granular structure of pure iron which can be seen in the background of figure two, but has a confused greyish appearance due to the fact that the pure iron in the molten condition has absorbed carbon from the more highly carbon bearing malleable casting with which it is in contact. It approximates in properties fairly hard steel, and is much too hard and brittle to serve as a welding material in the repair of malleable castings which are in general intended for service involving resistance to shocks and blows.

Welding malleable iron with soft iron is, therefore, impracticable, since it is impossible to prevent the contamination of the molten pure iron by the carbon of the welded casting.

Since grey iron castings can be welded using filler rod of extremely soft cast iron (very high in silicon) the suggestion has occasionally been made that it should perhaps be possible to patch malleage castings with grey iron. The thought was that even though the grey iron casting might be more brittle than the malleable, still it would be soft enough for machining, and particularly in relatively unimportant places might have sufficient strength to render its use possible.

In micrograph 5 is shown a section of a weld made in a malleable casting with grey iron. The grey iron did not preserve its softness, quite possibly due to insufficient silicon, and is present in the form of white cast iron. It shows white areas of iron carbide on a grayish background essentially in character to the white cast iron of Figure 1, and the remelted malleable of Figure 3. Even if this difficulty were overcome, by securing grey iron so high in silicon that it would remain graphitic in spite of the quick cooling, incident to its use as a filling material in welding, another difficulty would be encountered.

It will be seen in Figure 5 that the structure of the malleable iron which the grey iron has welded, has been materially changed. Instead of having the appearance shown in Figure 2, the background has become very dark, so dark that the masses of temper carbon are almost invisible, though they still exist.

This is due to the reabsorption of some of the temper carbon by what was originally the pure iron matrix of the malleable casting, converting the latter into a steely mass similar to that formed in the weld shown in Figure 4.

Figure 6 shows this structure at a higher magnification, and permits some idea to be formed of the ingredients present. This same reabsorption of carbon with a consequent embrittling of the product occurs when welding with malleable, or with soft iron also, being characteristic of the effect of reheating of the original material.

Some process of welding must be adopted which does not involve the heating of the casting to be repaired to a temperature above the critical point. This critical point is at about 1,350° F.

In Figure 7 is shown a piece of malleable iron welded with Tobin bronze. The melting point of this bronze is so little above the critical point that it is quite possible to melt it in the torch without unduly heating the casting being re-

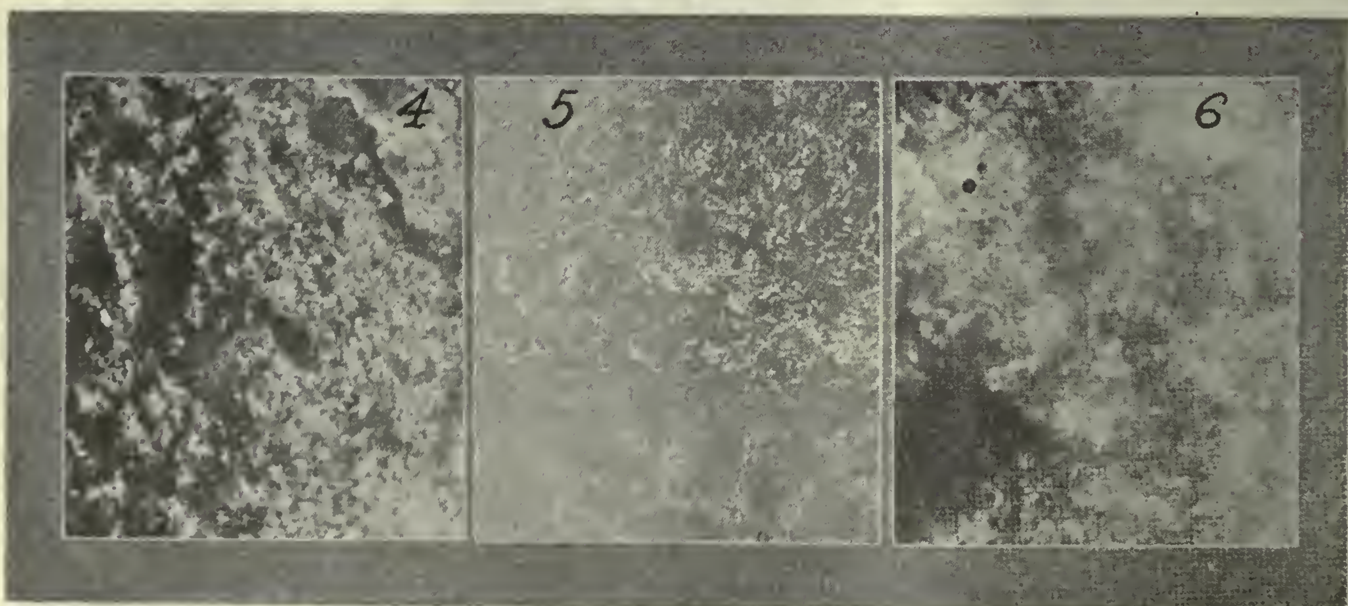


Fig. 4—Boundary between casting (at left) and filler (at right), mallable welded with pure iron. Etched with Nitric Acid and magnified 60 diameters
Fig. 5—Boundary between casting (below) and filler (above), malleable welded with cast iron. Etched with Nitric Acid magnified 60 diameters.
Fig. 6.—Malleable iron reheated in welding. Et tched with Nitric Acid magnified 240 diameters.

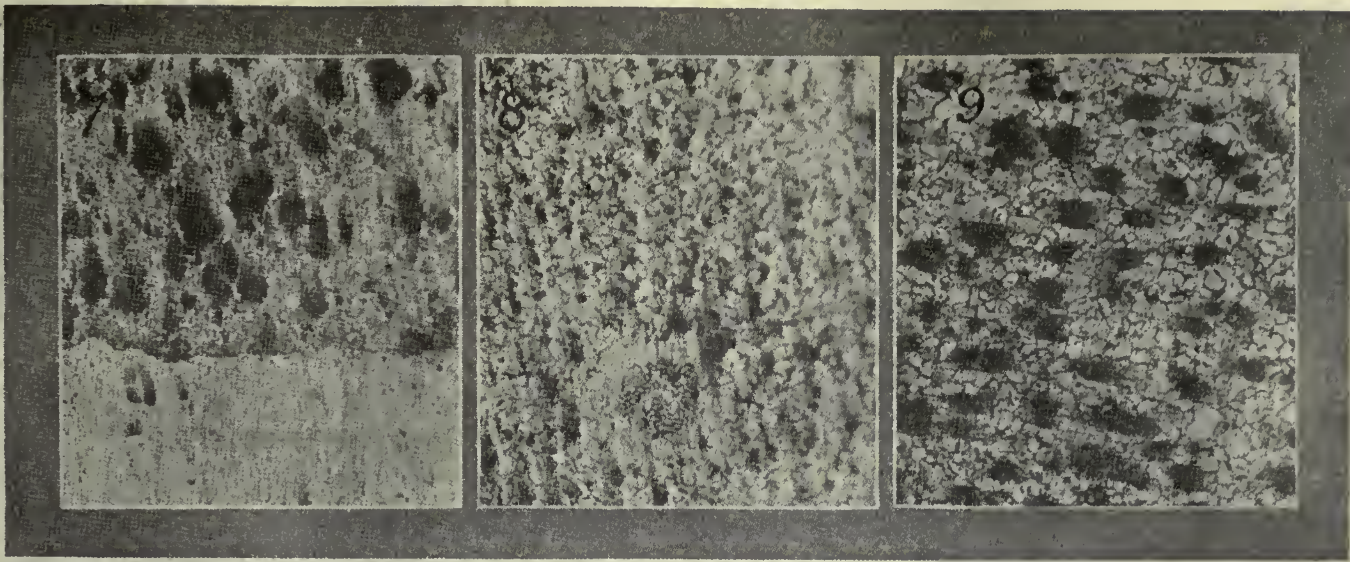


Fig. 7—Malleable Casting (above) welded with Tobin Bronze (below), etched with Nitric Acid magnified 60 diameters.
Fig. 8—Hard iron weld in hard iron casting annealed. Portion of filled in metal. Etched with Nitric Acid magnified 60 diameters.
Fig. 9—Hard iron weld in malleable casting annealed area near junction of castings and filler. Etched with Nitric Acid magnified 60 diameters.

paired. It will be seen in the photograph that little or no change of structure has taken place in the casting being welded. Unfortunately the bronze is not as strong as malleable iron, or does it adhere as perfectly to the iron as would be the case with welds made of some other iron material. However, for the purpose of making repairs where great strength is not required, this is an entirely feasible method of procedure.

It will be seen that all means of welding with iron so far described have been shown to be failures, largely because they undid what the manufacturer had done to the malleable iron in his annealing process. The conclusion is that if repairs could be made before the casting is annealed these difficulties would not be encountered. The microphotograph reproduced in Figure 8 shows a portion of a weld made in a hard iron casting, using hard iron as the welding material, and then annealing the casting as usual.

It proved impossible in this weld to locate the exact boundary between the original casting and the material welded, although the photograph was taken from an area as nearly as practicable where the two materials joined. It will be seen that this weld differs from normal malleable iron only in the finer grain. This is an advantage rather than a disadvantage, and welds made by this method will develop the original strength of the material if the skill of the welder is sufficient to avoid any blows or cracks during the process of welding. Unfortunately, however, this character of welding can be applied only in the malleable foundry, for example to reclaim castings it would otherwise scrap on account of blow holes or similar surface defects. It cannot be applied to the repairing of articles failing in service, since of course these articles have been previously annealed.

It is quite possible to weld broken or defective malleable iron articles using white cast iron as a filler, and then reanneal the casting in order to completely malleablize the latter and to destroy the combined carbon set up in the former due to the re-heating while welding. Figure 8 is a photograph of a weld made in this manner.

It will be seen that this latter method offers a solution of the difficulties encountered in welding malleable iron, provided the welder is equipped with facilities for heat treating the welded article in the same way as they were heat treated by the original manufacturer.

This heat treatment, involving as it does the maintenance of a carefully controlled and fairly high temperature for a considerable time and then the slow decrease in this temperature at a predetermined rate, may present difficulties to the inexperienced operator. It could hardly be attempted except in a heat treating furnace equipped with pyrometers, and would also require expert supervision. Properly executed the excellence of the weld under these conditions is limited only by the skill of the operator. Improperly executed the welded article may be totally ruined and be a source of extreme danger if used in some place where failure would mean serious loss or injury.

The welds discussed in this article were all made with oxy-acetylene. What has been said of course would, however, apply with equal force to welds made in the electric arc. Thermit welding is not likely to be of service in the repairing of malleable castings, due to their relatively small size, also due to the fact that the molten steel of the Thermit reaction would not be as suitable a welding material as is the white cast iron filler which can, and should be employed in arc or acetylene welding.

Malleable iron welded with soft iron would not respond properly to the graphitizing heat treatment since this treatment would not convert the combined carbon in the weld itself into body of the casting.

The company with which the writer is connected has made tests on a fairly considerable number of welds made under different circumstances. The result of these tests indicating first, that the serviceableness of a weld is primarily dependent upon the skill of the operator in producing a perfectly sound material and in avoiding the formation of mechanical defects in the weld itself.

WATER COOLING PROPOSED FOR TURBINES

Discussing the probable development of the large turbo-generators now used in power stations and on board ship, a paper read recently before the British Institute of Electrical Engineers, by Mr. J. Shepherd, suggests that water-cooling is inevitable. Mechanical strength and durability would, the author is convinced, be increased, and the risk of fire or heating diminished by the adoption of this change. He predicts a longer physical life for turbo-generators in consequence, and points out that this factor is of enhanced importance as a result of the world-wide rise in the cost of plant.

WISDOM OF THE HEN

The Smiths had a hen which insisted upon neglecting her comfortable nest to lay a daily egg in the coal cellar.

"I can't think," fretted Mrs. Smith, as she and her small son John together hunted for that particular egg, "why this one hen insists upon using the coal cellar."

"Why, that's easy, mother," exclaimed John. "I suppose she's seen the sign, 'Now is the time to lay in your coal.'"

DEVELOPMENTS IN SHOP EQUIPMENT

CINCINNATI LATHES

The Cincinnati Lathe and Tool Co., Oakley, Cincinnati, Ohio, have placed on the market their latest line of patented gear head lathes. These are made in 16 in., 18 in., 20 in., 22 in., 24 in., 26 in., and 28 in. sizes, with either single pulley or motor drive.

The machine shown at Fig. 1 is what is known as a General Manufacturing Equipment lathe, fitted with hexagon turret on bed, power feed silent chain drive. As the speed variations are obtainable in the head, constant speed motors only are required.

Levers at front of head operate all feed changes and the index plate gives the lever position for each speed. A neutral position is also obtained, permitting to revolve spindle by hand for chucking similar jobs.

Spindle is made of high carbon crucible forging. It carries only the face gear, and one direct driving gear. The intermediate shaft has three sliding gears that mesh with back gears. The back gear shaft carries a pair of sliding gears, and three stationary gears of different diameter. The drive shaft, operating at constant speed, consists of two sliding gears meshing with gears on intermediate shaft. When the gear to the left of this shaft is in mesh with the gear on intermediate shaft, it gives the first six changes of low speed. When meshing the gear to the right on same shaft, the additional six changes for the higher speeds are secured. Shafts in this head are of high carbon nickel steel.

Gears on back gear shaft, also the direct driving gears, are made of steel forgings heat treated. All the others are of high carbon nickel steel, bushed throughout with best bronze. Teeth of gears are rounded. Only the gears actually used for driving and in mesh consuming all the power on work produced.

All bearings and gears, including those not in use, are oiled automatically by the splash system. Indicator shows amount of oil in base of head. Oil is properly distributed by the gears to grooving provided in top cover. The rotating shaft bearings, therefore, are kept oiled.

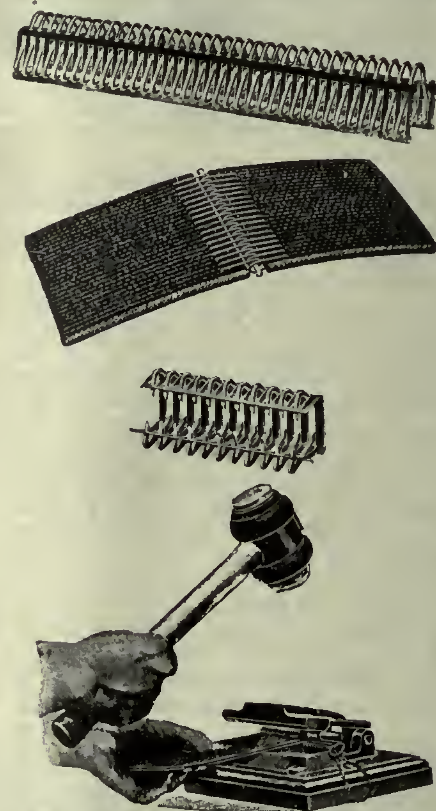
Fig. 2 shows their patented geared head lathe for single pulley belt drive, driven direct from a line shaft, therefore, no countershaft is needed, or direct connected motor drive. The motors are mounted on head stock or in rear of cabinet leg, driving through belting, silent chain or gearing. Variations are obtained in the head, therefore, only constant speed motors are required.

Twelve speed changes in geometric progression are secured on these lathes and all through sliding gears by simply shifting three levers, the levers and gearing being so arranged not permitting them to lock while operating. Any lever may be shifted without interfering with the other.

At the apron is a control by which the spindle may be stopped, started or reversed without stopping the overhead works or the motor.

UNIVERSAL BELT FASTENERS

An improved type of belt fastener, known as the "Universal," has been placed on the Canadian market by the Climax Company, of 244 Lemoine Street Montreal. These fasteners are the result of careful study and exhaustive experiment on the part of the makers, and are universal in character. They are equally efficient in rubber, balata, leather or cotton belting, and are made in six-inch lengths, of sizes varying to take belts from 3-16 to 7-16 inch in thickness.



VIEWS SHOWING INTERMEDIATE MACHINE AND OTHER DETAILS.

The individual hooks are held in position by a metal frame which retains the hooks in the same relative position all the time the hooks are being forced into the belt. When the hooks are flush with

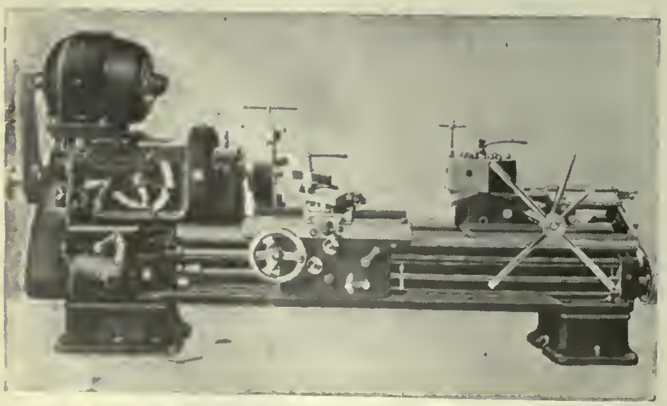


FIG. 1—SHOWING THE GENERAL MANUFACTURING EQUIPMENT.

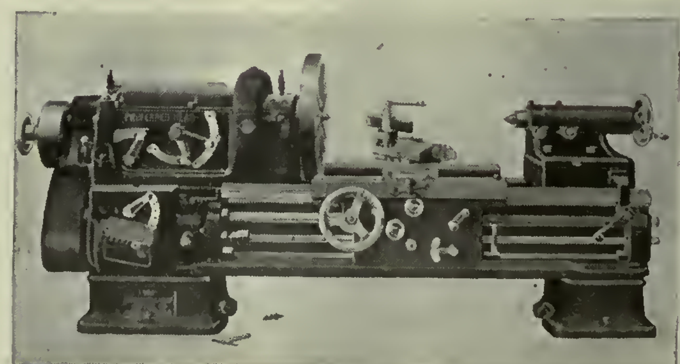
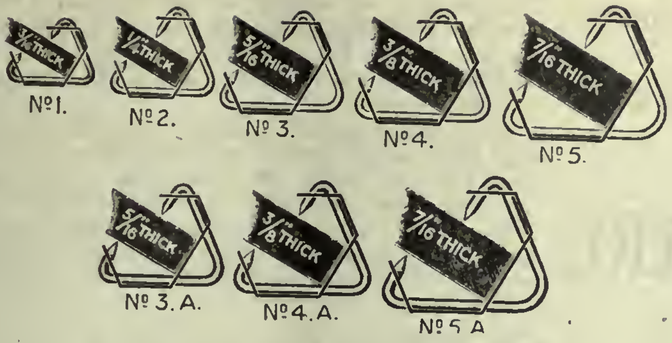


FIG. 2—THE GEARED HEAD, SINGLE PULLEY DRIVE.



VIEW SHOWING THE VARIOUS SIZE HOOKS.

the belt the frame slips off freely. The fasteners are made in two gauges of wire, the larger sizes being adopted to meet the requirements of the user who has extra heavy belts running over small pulleys.

On the intermediate fasteners the wire can be laced into the belt with a simple hammering tool, economically and efficiently. For the larger sizes, a special lacing machine is preferable. On the smallest sizes, the lacing can be performed by using a hammer and a wooden block, the metal frame assuring perfect alignment during the operation. The great advantage of the metal frame is that it prevents the hooks from twisting to one side or the other while being forced into the belt. The fasteners are made with a series of hooks having long and short legs, the short legs entering the belt on the pulley side, this method minimizing the metal contact on the pulley and reducing the possible slip. The hooks do not meet in the belt, but

THE HEAVIER TYPE MACHINE.

are individually staggered, thus increasing the effective pull.

The fasteners can be cut to any desired length without fear of wasted ends, as the metal frame keeps the pieces intact. A pair of narrow scissors are provided for cutting the metal frame.

CLIMAX KNEADABLE METALLIC PACKING

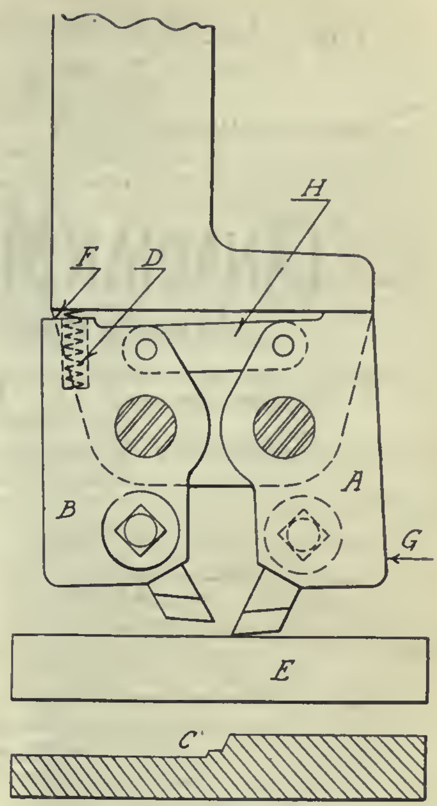
The Climax Kneadable Metallic Packing is another line carried by the Climax Company, and is also universal in character, as it is applicable to every class of service. It is equally efficient in extremes of temperature or pressure, steam engine or refrigeration work, revolving or reciprocating rods and pumps

of every description. It is not necessary to provide various sizes of packing to meet the different needs, as the Climax packing can be kneaded into any shape, size of style of gland or stuffing box. It is claimed that the packing never burns or even gets hot, does not harden or crystallize, and is non-destructible, as it can be used over and over again. It is composed largely of asbestos and graphite, and, therefore, is self lubricating. It is easy to get in and easy to get out, and is extremely efficient under severe service.

THE "BOTH WAYS" TOOL HOLDER

The possibility of using, effectively, the return stroke of the planer or shaper, has long been the desire of production men. The tool here illustrated has recently been designed and thoroughly tested, and, it is claimed, found to meet these requirements in every particular. As shown in the sketch, the lower end of the shank is enlarged and slotted to take the two small tool-holders, A and B, that carry the cutting tools. The cutting points of the two tools are offset, so that the finishing cut is taken about 1-16-inch from the roughing cut. In the normal position the finishing tool is retained in a cutting position by the action of the small spring D; the short connecting link H operating the two tool-holders in unison.

In working with the tool, the clapper of the shaper or the planer must be rigidly secured to the toolhead with a locking pin or set screw, to prevent the clapper from oscillating on the return



A DETAIL VIEW OF HOLDER.

stroke. No back drag takes place, as the idle tool on each stroke is raised from the work by the swivel of the small tool-holders. The cross-section at C shows the relative position of the roughing and the finishing cuts. When setting the tool bits, a parallel piece E is placed on the vice or planer bed, and the tool-holder lowered until the front bit or finishing tool, in A, is touching the parallel. The tool-holder is then pressed at the point G until the shoulder at F rests against the bottom of the slot. The roughing tool bit is then allowed to touch the piece E and secured in this position. The tool is then ready for operation. All parts are made of drop-forged, machine steel, packhardened. The pivot pins are of hardened tool steel. The Jas. Buckley Company, Montreal, are the exclusive Canadian distributers for these tools.

Toronto.—In the suit brought by Fred Torno against Frank W. Callaghan, M. J. Shaw and W. R. Sweet for a declaration that they hold the steamer Chicora in trust for him, to become his on the payment of $4,400, Justice Orde reserved his decision. Torno admitted that he was a Russian, and Mr. Callaghan's lawyer questioned the right of anyone not a British subject to own a ship on the British register.

Montreal.—The National Shipbuilding Company of Three Rivers have received contracts for ten cargo carrying steamers from French interests. The purchasers represent three different interests. The vessels will be used as wine carriers and oil tankers.

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PRINCIPAL CONTENTS

The Position of Canada

REPORTS come from New York and other American centres that there is anticipation of a financial "crack." People should be careful of repeating this sort of stuff.

Confidence is the cornerstone of business in any country, and the lack of confidence means disaster and blue ruin.

It requires very little courage to sit back and say "Things are going to crack." And once we get a lot of people sitting back and chanting "Things are going to crack" we are in a fair way to realize our worst expectations.

Now, our times are going to be good or bad in proportion to what we put in the markets of the world. If we sit back, as a people, and loaf, we shall reap the harvest of a loafer.

The manufacturing and commercial interests of Canada are to-day good customers. They want a lot of machine tools, supplies, iron and steel, and metals, in finished and semi-finished stages. They have the money and are not asking for credit. Their books are in good shape, and as a general thing it is safe to say they are more solvent right now than ever before.

Although this paper is interested primarily in mechanical matters, it cannot be blind to the fact that the basis of our real wealth must increasingly continue to be in the land. Our buying power is welded and banded to our ability as a people to produce new wealth, and the places we can produce new wealth are (1) the land, (2) our streams and lakes, with proper care for restocking, and (3) our forests, with a sane and enforced system of replanting. With these three essentials in operation, our manufacturing can go ahead in the certain knowledge of success, and a reasonable return on investments.

There are associations to-day who seem obsessed with the idea that our national success rests on a tariff wall "as high as Haman's gallows," to use a popular phrase. Against this we have a large class who hold tenaciously that the wiping out of tariffs would be the panacea for our national ailments.

These classes are both wrong. They are wrong because they both take a selfish, sectional view of the situation. They get a pet hobby and a notion so close to their eyes that they cannot see past to a national outlook.

There are counties in Canada where there has been a decrease in population of 14 per cent. since the war started in 1914. There are cities where there have been 20 per cent. increases.

The people in Canadian cities and towns should make an honest effort to understand the problems of the farmer, and the farmer should try and see what the town and city man has to contend with. When we go forward together we cannot well be stopped. When we spend our time lining up country against city we can be stopped, and that mighty sudden.

Some high-brow has been delivering a bit of an address on the "Educative Value of the Movies." Our most vivid memories are of scenes where the hero operated on the villain's neck with a meat axe, or where some person dropped a custard pie on Charlie Chaplin's jaw.

Almost every day in the week one hears of something that has taken another advance in price. No doubt we are in an era of high values, with everything steaming along under peak capacity. All will be well until some tinker comes along some day and breaks the peak off.

Howard Elliott, President of the Northern Pacific Railroad, is reported to have stated before the Association of Life Insurance Presidents at New York recently that United States railways need an equipment of $3,000,000,000, and that if provision is not made for developing railways continuously the cost of living, instead of being reduced, will go higher.

Calgary barbers have got behind the price of hair cut and boosted the hang thing up to 75 cents. And it wasn't so many years ago that we used to sing a little ditty about "Johnny, get your hair cut, 15 cents."

Ireland in the Columbus "Dispatch."
"All right, boys, go over and pick out your railroads!"

WHAT HAS BECOME OF THE SHELL BUSTER?

Well, Here's One Chap Who Turned to the Machine Shop and Has Stayed Right There

WHAT has become of the shell buster? When the shell contracts were over there was a lot said about this chap. If he were a barber before, he would go back to his chin-scraping, and if a laborer before, then back to his labor.

Perhaps this turned out to be true, and perhaps it did not. Here is the experience of one with whom CANADIAN MACHINERY came in contact a few days ago. He went into a shell shop early in the game. His highest wages previously had been from $15 to $18 a week, this being from an office position in a shop where a shell contract was secured. It was not long before he had doubled and trebled his best previous earnings. He worked at one operation for almost three years. When the shell business was over he did not go back to his desk. The $15 to $18 chance was still there.

He went to another shop and was soon a piece-worker again. He was not, and is not now, a mechanic, and he makes no pretensions that way. But he is handy and a plugger.

His pay now averages not far from $40 a week, and he has been making this for some time past, and the chances seem to be that he will keep on making it.

Well, what about it? This former shell buster is single. He tried to enlist, but his eyes were against him.

When the chance came to buy Victory Bonds through the shell shop, he went in right to the neck. He has taken a good-sized slice of each loan since. When he gets this year's paid up he will have $4,500 gilt-edged security tucked away. He lives in a modest way—dresses well, and is not miserly by any means. And in these few years, from a $15 to $18 clerk he has turned to the shop and has securities that give him an income of about $250 a year. In other words, his fixed income now is about a third of what his total wages used to be before he turned to the shop end of the business.

In the case of men who are married and have families to support, it is a different proposition, and we are not trying to stretch the case to preach to them.

There are, just the same, quite an assortment of single men making good wages now in mechanical pursuits. The good wages are bringing them a fast pace and a merry one, and nothing more.

This former shell buster may not thank this paper for using his case in print, but it is good business now and then to bring these matters to the front. The habits of thrift that carry with them the average man's only chance for any degree of independence, are not as firmly established as they ought to be.

We know it's a great thing to be a good fellow, a real sport, a good spender, and all that. It's also a nice thing—much nicer, in fact—to have $4,500 of your savings stowed away.

The Moscow Soviet informs the world that the people of Alaska want to leave the States and form a Soviet government. When some of Uncle Sam's subjects get through running Ireland for John Bull they may find a new problem in their own territory.

Speaking of clothes, clothing and the lack of it: "It was eating the apples that taught Eve she was naked, and so far as I can see, it is nearly time to pass the apples again," said Mr. Halbert, former U. F. O. president, speaking at Lambeth recently.

The Recovery of France

REMARKABLE progress has been made in the rebuilding of the devastated areas of industrial France. The Guaranty Trust Company of New York says: "France, instead of idling, as some observers have reported after a cursory survey of the country, has accomplished in the last year so stupendous a task that one marvels how the work has been done. Seventy-six thousand structures had been erected or repaired by the end of August, 1919, and 60,000 additional buildings were then under construction. About 550,000 buildings were destroyed or damaged during the war. In the same period 89 per cent. of the destroyed railroad trackage had been rebuilt, an area of 1,500 square miles of shell-riddled, tillable land cleared up; 80,000,000 cubic yards of trenches filled; 991,000 refugees returned to their homes; 5,000 schools reopened, and 3,872 civic communities reorganized.

"The French people have made surprising progress in the period since the armistice in readjusting industry to a peace basis. As early as February, 1919, the Minister of Industrial Reconstruction reported that out of a total of 1,700,000 employees occupied on November 11, 1918, in a group of Government and private plants, 1,300,000 were already engaged in peacetime pursuits.

"A later investigation conducted in 1,986 industrial plants in the occupied area, employing more than 20 workmen each, shows that by November 1, 1919, a total of 1,385 establishments had resumed operation. By November 15, 1919, the Government had made advances in excess of 3,000,000,000 francs to the industrial interests of this region for the reconstruction of their factories, and the budget for 1920 provides for the expenditure of nearly 5,000,000,000 francs during the first quarter for the same purpose.

"During 1920 France will need about $650,000,000 worth of foodstuffs and raw materials, as follows: Foodstuffs, $150,000,000; cotton, $200,000,000; copper, $70,000,000; oil, $75,000,000; chemicals, tobacco, metallurgical products, fuel oil and coal, $150,000,000."

Finishing a job is not always an easy matter. Often it's much easier to quit cold. But Carnegie stuck to steel and Rockefeller to oil.

They do tell that in a short time there will be automatic phones in use all over. So when a man asks or rings for a wrong number and gets it he won't be able to call the girl at central a bonehead. Thus will another little pleasure pass away.

The Antidote for "Reds"
—Thomas in the Detroit "News."

MARKET DEVELOPMENTS

Larger Output Not Reflected in Deliveries

Small Shipments Coming Along and No Sign of Betterment—Prices Do Not Interfere With the Demand for New Standard Machine Tools

ALTHOUGH figures show that the production of steel in its several forms was much higher in February than in January, the dealers and users in Canada state that they can see no change yet. They look upon actual deliveries here as a better indication of output than any figures that may be compiled elsewhere. One result of this state is that the premium operators are having a chance to work to quite an extent. The broker and the jobber is doing quite a trade. It is a hard matter to get absolute quotations on several lines, as the price depends upon each individual order and sale. This is especially true regarding sheets, black or galvanized.

Despite the high costs and extras connected with the installation of new machine tools, the trade finds that there is no dropping off, or no particular desire to turn to used machinery. It often turns out that the increased production with the new equipment more than makes up for the increased cost. Labor-saving machinery, of course, is also included in this.

Warehouses are not taking on much stock. There are several reasons for this. In the first place they do not care to in view of the prices, and in the second place, the demand for anything they can secure is so insistent that it goes out to the consumers almost immediately. As high as 12 cents a pound was paid during the week for a lot of galvanized sheets, and the resale price would be above this figure. Of course, that is not the market price, but is given to show where some of the premium operators are working.

The scrap metal trade remains quiet. There is a big market for heavy melting steel, cast iron and stove plate, but unfortunately there is not any quantity of this material coming. There is an old saying in the yards that "When the snow goes the scrap pile grows." It will be a profitable growth this year, as prices for the wanted lines are high and firm.

SHIPPING CONDITIONS HINDERING BUSINESS IN MONTREAL DISTRICT

Special to CANADIAN MACHINERY.

MONTREAL, Que., Mar. 25. — In addition to the exchange handicap that at present affects industrial development in the matter of getting materials from the States, the car situation has increased the difficulties under which the manufacturers here are required to carry on business. The inability to get adequate car service has resulted in holding up large quantities of valuable product that should have been shipped to the States. This is in consequence of some of the American roads placing embargo on all but commodities that are considered essential to American industry. The situation is one that does not reflect favorably on the action of the American roads, as it is reported that 60,000 Canadian cars are at present on United States roads, against 40,000 American cars now in this country. There is little hope that shippers here will be granted a respite in regard to freight charges on goods going to U. S. destination, and prepayment on goods will not be accepted on such shipments. Some arrangements may be made to confine the added charge to the mileage on the other side of the line; and where shipments are sent direct to coast ports for export the charges may be modified. Shippers are anticipating some relief on the opening of navigation, but the actual date of this event is still a question of a river free of ice, and such a condition is dependent on the progress of the ice breakers and on the early weather conditions.

Car Shortage Affects Supply

The demand for steel shows no apparent let-up, and the experience of dealers in getting material in from the States is still one of considerable difficulty. Transportation is a deterring factor and consumers here are seldom in a position where a surplus on hand relieves them from the worry of anxiety as to future needs. There is this about the present situation, that manufacturers who are able to secure sufficient for their immediate needs and for uninterrupted operations, the thought of the distant future is one of optimism. Few consumers are anxious to load up with material at the figures now obtaining. In the matter of plates, sheets and tubes, the customer is satisfied to pay a good stiff price, realizing that it is invariably the practice at the present time for the dealer to pay a fair premium for prompt delivery of this class of material. Prevailing conditions has reacted favorably towards Canadian mills, especially on the smaller bars and shapes, and the tonnage on these lines has shown large increases.

Delivery Still a Drawback

One of the principal reasons for the apparent scarcity of machine tools, or rather the inability to get definite delivery of same, is the undoubted demand that comes from overseas. It has been stated that orders of considerable extent have been placed by some European countries for machine tools in the States, and this condition makes it comparatively difficult for Canadian buyers to secure early shipment on needed machinery. While many machine tool builders in the States have made it less difficult for buyers here to obtain equipment, the situation is still one that prevents a free placing of orders in the States. The trade continues to practise conservatism in the matter of buying, and this is particularly pronounced in regard to supplies as users are reluctant to acquire any more than they are actually in need of, when prices are at or near the apex of an unusually high market.

The business done in used machinery is still of good volume, and dealers are making a profitable turnover on these lines.

Firm Scrap Market

The old material market reflects the continued demand that prevails for nearly every class of commodity, both in steels and metals. The requirements for the latter are not as pressing as those of iron and steel, but the volume of business is of a steady character. During the past week there was an evident easing of prices, but the market has again developed a firmness that promises to remain for some time. The scrap iron and steel situation has been sustained by the constant demand for all lines of materials and prices quoted are a fair average of those paid by dealers, although quotations on heavy melting steel and cast iron scrap might be marked up a little and still be within the range of the market. Dealers here stated that shipments to the States of steel scrap has dropped, as the mills here are working to capacity and in a position to take care of the greater volume of accumulation. Machinery scrap is still a scarce article on the market and the foundries are always on the lookout for available supplies.

BECOMES HARDER TO NAME PRICES

Premium Sales Really Set the Pace if Anything Like Prompt Delivery is Desired

TORONTO.—"Yes, we know there is danger in the rising market, and our customers know it also, but that does not seem to make any difference in the amount of trade that is passing, and that is in sight." Such was the view of one large dealer in machine tools to-day. "It is a strange thing," he continued, "but there is always some force ready to meet any unfavorable circumstance that comes into the market. Just now the price might look to be a stickler, but it is not, and the man who comes into the market wants to buy the latest thing in machinery, because he finds that the increased production he will get as a result will more than make up for the added cost in the first place. I believe the present situation in the labor market is having much to do with keeping up the demand for high class production tools."

There is still a good demand for used machinery, although it is not stopping the sale of new machines to any extent. When a person wants a machine in a hurry the chances of placing a used tool come to the fore, but, as stated above, the chance of getting something that will give greater production and cut costs and operating handicaps are not to be overlooked.

Figures given from Pittsburgh, and which are reviewed in the Pittsburgh market letter in this section, mention the gratifying increase that has been made in the month of February over January in the way of ingot production. From this they go on to reason that there will soon be a catching-up noticed in the matter of supplying material to the trade and to the jobbers.

Several of the Toronto dealers, when asked if there was anything coming under their observation to bear out this reported improvement, stated that they could judge very little by the figures given out from Pittsburgh at times. "They can show a lot of things in figures, but the real test is the ability to put material over here. Delivery to the consumer is something far better to go by than statistics."

It is becoming increasingly difficult to quote prices on such lines as plates, sheets (black and galvanized), etc., owing to the varying circumstances that surround each sale. There is no desire on the part of the dealers to work the premium business to the disadvantage of the consumers. Most of the dealers in this district have their line of customers and they are trying to look after them as best they can in the way of supplies. There is nothing to indicate that the supply of sheets, for instance, is going to improve. Galvanized is one of the worst spots in the market, and a number of the dealers have not a galvanized sheet in stock. Under such circumstances they hesitate to name prices. "It is easy to name prices when you have nothing to sell," is the way one put it, "but what is the use?" Small lots of galvanized have gone to jobbers at as high as 12 cents, and the resale price would be above this again.

Jobbers are facing a peculiar situation just now. When they get a shipment of some of the much-wanted lines, they could dispose of the whole thing at one stroke, but they deem it better policy and fairer business to distribute the material, and let all their trade, as far as possible. It takes more work and more accounting, but it is giving a service that is much appreciated just now.

A limited quantity of boiler tubes are coming through now, but against the supply there is an accummulation of orders that it will take some time to satisfy.

An increase has been announced in the selling price of cold rolled, the mills having raised the price by 75c per 100 pounds. The new warehouse prices are $7 per hundred base for rounds and squares, and $8 base for flats and hexagons. These prices, of course, are subject to the standard extras for size.

The prices at which material is selling is not having the tendency to fill up any of warehouses. Dealers who take on a large tonnage get mostly premium steel, and they are anxious to get rid of it and get their money out. None of them are taking a long chance at being loaded with material bought at fancy figures.

Scrap Metal Dull

"As the snow goes down the scrap pile starts to go," is an old saying in the trade, and the dealers are hoping that it will prove true this year, especially in regard to material that looks like heavy melting, cast iron or stove plate.

Cast iron is much wanted, and there is nothing showing up to indicate a coming-in of this stuff. As a general thing it comes in quantities only when a plant is being broken up or replaced. Its origin and volume is quite different from turnings, which always keeps up a fair volume. Heavy melting is also in demand and scarce, and prices which we

POINTS IN WEEK'S MARKETING NOTES

New York claims that as far as the Eastern States are concerned there has been a falling off in inquiries for machine tools.

It is becoming more difficult for dealers to place a price on such articles as plate, sheets, black or galvanized, etc. Much of the stock they are able to secure comes from premium mills, and often sales are made to highest bidders.

As high as 12 cents was paid by a Toronto jobber this week for galvanized sheets, the jobbers profit going on top of this again.

Scrap metal trade is quiet, but demand for heavy melting steel, cast iron and stove plate continues keen, with prices correspondingly good.

A few shipments of boiler tubes have come in, but nothing to meet the demand that has been piling up.

Machine-tool dealers in this district claim that high prices have not stopped the sale of production machinery, buyers figuring that the greater output will help to balance the labor costs.

There is a fair amount of used machinery moving, but not as much as the price and scarcity of new equipment might indicate.

Iron and steel figures show a big improvement in February over January, but dealers and consumers in Canada can see very little change for the better.

U.S. railroads are not doing the buying that was predicted for them. They are moving very cautiously.

quote would no doubt stiffen were a good-sized tonnage to come in sight.

The small dealer, with the coming of spring, will get out into the country again, and there should be an improvement in the volume of material offering. Prices remain firm at the new list announced a week or so ago.

There is little, if any, change in the price of metals. There is a steady demand for all kinds.

EASTERN STATES QUIETER IN TOOLS

New York Reports a Falling Off in Inquiries for Equipment

Special to CANADIAN MACHINERY.

NEW YORK, Mar. 25.—Reports from salesmen covering a larger part of the East for one of the leading machine-toll houses indicate that conditions of business are generally quieter in this line. This has been the trend for the past two or three weeks, as has been indicated in these reports. Of course the comparison is with a period ranging from November until late in February, when an unprecedented volume of business was done. It cannot be said that business is dull, for a very fair volume is still being done in some lines, but the number and size of inquiries have dropped off and orders are a little harder to close. High prices and long deliveries are undoubtedly the principal factors in the slight lull which is now present.

The railroads have not yet bought much new shop equipment, but the indications are that a fair amount of buying will eventually develop from this source. The New York, New Haven & Hartford has closed for a part of the tools it recently inquired for and the New York Central has made some purchases. The Lehigh Valley came into the market recently for a small lot of equipment. The American Locomotive Co., which was a large buyer a few months ago, has inquired for twelve or fifteen more machines to round out its former purchases.

The General Electric Co. has for some months been one of the foremost buyers, and it is evident that it will continue to furnish business to the machine-tool industry for some time to come. Its latest inquiry covers more than fifty tools for its new Bridgeport, Conn., plant, which was one of the war plants of the Remington Arms Co., and which last week was leased for a term of years, with option to purchase at a reported price of $7,000,000. The Bridgeport plant contains considerable equipment, not all of which will be of value to the General Electric Co. for its purpose, which is the manufacture of small motors. The Edison Lamp Works of the General Electric Co. is also in the market for a list of new tools for its machine shop at Waverly, near Newark, N.J.

PITTSBURGH BELIEVES THAT BETTER TIMES ARE COMING FOR CONSUMERS

Special to CANADIAN MACHINERY.

PITTSBURGH, March 25.—Since the steel ingot production report for February, referred to in last letter, came out the trade has had an opportunity to study the remarkable showing it made. It will be recalled that the report indicated that the production during February was at the average rate of 44,200,000 gross tons a year. This was a remarkably heavy tonnage, seeing that during the month the common reports were that the mills were averaging only 75 or 80 per cent. of capacity, while there had been no reputable estimate of capacity being greater than 50,000,000 tons. Either the mills were not hampered nearly as much by weather, by poor transportation conditions, and other factors, as had been assumed, or the capacity is materially greater than hitherto assumed.

The common conclusion in the trade, after studying the evidence, is that the reports of the mills being hampered in their operation in February were wholly or largely true, but that capacity is going to be found materially greater than has been assumed, whenever physical conditions permit of the mills operating at their greatest efficiency. Capacity may be found to be in the neighborhood of 55,000,000 tons of ingots a year, which would mean that the February production was 80 per cent. of capacity.

Still Better Supplies in Prospect

Whatever the capacity, the February production is an accomplished fact, and if under favorable conditions one-fourth or one-fifth more steel can be made, supplies will eventually be greater than was expected. Even now there are not a few reports of manufacturing consumers being comfortably supplied with steel, if not more than comfortably.

Supplies to consumers are better not only by reason of the increased production, but also by reason of better rail movement. The accumulation of finished steel at the mills have been reduced somewhat, while a more important factor is that freight is less delayed in transit. As the time shipments are on the road is decreased the quantity of steel delivered exceeds the quantity shipped in the same period from mills.

The position of jobbers is different from that of manufacturing consumers. Whether because the mills have definitely given preference in the past few months to manufacturing consumers rather than to jobbers, or because the call upon jobbers' stocks has been especially heavy, nearly all the jobbers are practically bare of stocks.

Railroad Buying

The railroads are buying quite cautiously. Freight car orders placed thus far make no large total, and orders placed plus present inquiries in the market total only about 50,000 cars. However, such an amount of car buying would keep the car shops busy until late in the year, as they will require some time to get into quantity production. There is very little bridge and other structural work coming from the railroads, while rail orders are small, nearly all the year's requirements being covered by previous purchases. The requirements are only for replacement purposes, there being practically no track laying in contemplation at present. This will follow the formulation of comprehensive plans for improvements, to come later.

While the railroads are prevented from making heavy purchases at this time by the fact that extensive financing would be necessary. it is probable that they are pursuing a conservative course partly on account of the price situation. The Steel Corporation will sell to railroads, or for railroad account, at March 21 or Industrial Board prices, but has no large amount of steel to spare for this year, while among the independents there are few if any that will sell even to railroads at those prices. Doubtless the railroads expect that later they will be able to buy on more advantageous terms than at present, when the steel market is still feeling the effects of shortage in supplies.

Price Trends

There is a very strong balance of probability that about April 15 or shortly thereafter, the American Sheet and Tin Plate Company (Steel Corporation) will open its books for sheet and tin plate contracts, for second half delivery in the case of manufacturing consumers and for third quarter in the case of jobbers, naming prices the same as hitherto adhered to, the March 21, 1919, or Industrial Board schedule, with blue annealed sheets, 10 gauge, at 3.55c; black sheets, 28 gauge, at 4.35c; galvanized sheets, 28 gauge, at 5.70c and tin plate, 100-pound at $7.00, base. Late in February sheets for prompt shipment sold up to a basis of 10c for common black, while in the past week or two the maximum has been about 8c. With the prospect of 4.35c being named on black sheets for second half, therefore, it is quite improbable that the Steel Corporation will make any general price advances. There is even considerable doubt now whether it will advance nails, as was expected, on the basis that an advance in nails would be in the nature of a readjustment, since the $3.25 price in the Industrial Board schedule is particularly low by reference to cost of production.

In prompt deliveries steel prices are certainly on the down grade, though outside of the case of prompt sheets, noted above, the declines thus far have been small or imperceptible. Offerings for early deliveries are so very light that it would not require much tonnage demand to hold up the market or even

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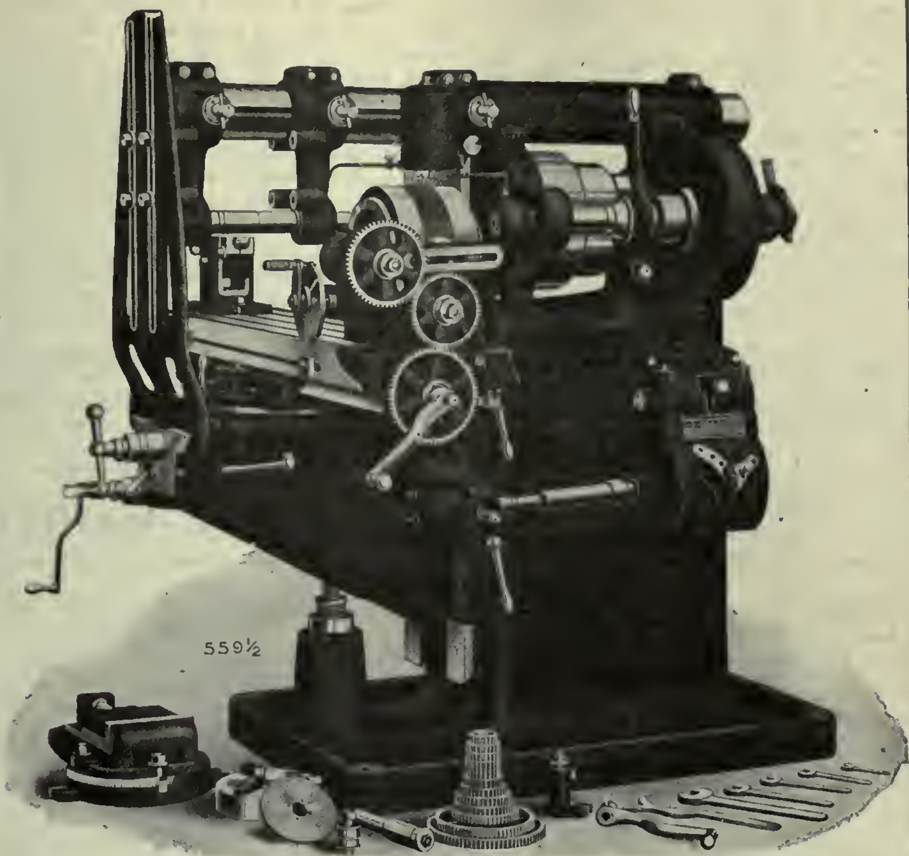

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advance it, but there is not enough demand to do this.

The conservative independents, who sell some distance ahead, are displaying distinctly more moderate views than a few weeks ago, and make it plain that they they do not contemplate any advances for third quarter, when they come to open their books generally for that period. This, of course, leaves it as a possibility that prices will prove slightly lower.

Pig Iron

There is much talk in the pig iron market, but very little action indeed. It is argued that the market is strong because so much foundry iron has been sold ahead, but on the other hand buyers have purchased as much as the furnaces have sold, and will have correspondingly little buying to do in future. The buyers were in a very excited frame of mind when they made the purchases, as the market was advancing rapidly and showing no signs that it would ever reach a limit. There were many predictions of $50 iron appearing, but the market fell far short of justifying the predictions. Pig iron prices are higher relative to other commodities. The foundries which bought iron at over $40 may have been entirely justified in doing so, through having sold their castings at commensurate prices, but the steel works that use pig iron have not bought second half iron to any extent and are not justified in buying at present prices, when they are not in position to sell their steel, and when current market prices for steel, for deliveries beyond relatively prompt, are much lower, relatively, than present pig iron prices. The market seems to be quotable at $42 for Bessewer, $41.50 for basic and $42 for foundry, f.o.b. valley furnaces, freight to Pittsburgh being $1.40, but there are odd lots of foundry that might be picked up at concessions, and there is certainly no delivery premium on either of the three grades mentioned, while in all the past there has never been a high market without there being a delivery premium on foundry iron at least.

The Week's Events in Montreal Industry

P. Reynolds, formerly chief inspector of Lymburner's, Ltd., has become associated with the St. Lawrence Welding Company, Montreal.

There is every possibility that the completion of the aqueduct improvements, in connection with the Montreal waterworks, will be approved by the city council. It is understood that a board of engineers will be appointed by the Administrative Commission to carry out the remainder of the contract, which will entail the further expenditure of about $4,000,000.

At a recent meeting of the Engineering Institute of Canada, R. de L. French described the steps taken by the Dominion Government for the development of the lignite fields in this country, the deposits in the Western provinces being estimated at upwards of 3 billion tons. Mr. French stated that considerable experimental work had already been done in the utilization of this class of fuel for industrial purposes. The use of lignite as domestic fuel has not yet received much attention, but the Lignite Utilization Board are making progress in this direction.

At a meeting of the directors of the Dominion Steel Corporation, which will be held this week, it is expected that Roy M. Wolvin will be elected to the position of president of the Board, and that Mark Workman, the present holder of the office, will be made chairman. Mr. Wolvin, while not a steel man, is an authority on transportation subjects, and as shipping facilities are to be a feature of the company's business, his experience and ability in this connection should be of inestimable value to the company.

The death of Harry Osborne, late works manager of the C.P.R. Angus shop, removes from the circles of railroad activity an able and efficient personality. He was respected by all who knew him, and his ability to adjust labor disputes to the entire satisfaction of employees and the company has been one of his marked characteristics. He was 61 years of age, and has been in active railroad work for the past 40 years, and with the C.P.R. almost from the time of its organization. On his retirement a year ago, he was presented with a purse of gold by the employees of the Angus shops. His release from active participation in railroad work is said to have affected his general health. He is survived by a widow, two daughters and one son.

PIG IRON TRADE

The pig iron market is generally quiet although a fair amount of business is being done. There are some good enquiries for export iron. Basic is firmly established at $43. Following are reports from various U. S. points:

Philadelphia. — The market here is steady, with a fair volume of business being done. $1.75 to 2.25 silicon iron is being sold Eastern Pennsylvania furnace, but a number of sales of this grade for prompt and second half delivery have been made at $44 and $45. Production is being handicapped by the coke shortage.

Chicago.—The dullness which has been in evidence for a couple of weeks past still prevails, with the exception perhaps of spot iron. Southern iron for spot delivery is selling at $42 Birmingham, while what little northern iron comes through is $45 Chicago furnace for No. 2 foundry.

Pittsburgh.—Ten thousand tons basic has been bought by a local steel company at $43 valley furnace, and this seems to be the minimum price for this grade at present. Bessemer has been quoted at $42 valley furnace for third quarter shipment. There is a good enquiry for foundry iron, and sales of No. 2 foundry for second quarter have been made at $42 valley furnace.

Boston.—New England points are still embargoed and foundries have not yet received the looked for relief. Spot iron is in good demand but there is little interest in last half iron. One Pennsylvania interest is quoting $42 for first half iron and $43 for last half, though the premium is usually on first half rather than last.

U.S. SCRAP METAL

While in some districts prices have gone up, in others they have weakened. This follows the trend of business, which is dull in some districts and active elsewhere. Following are reports from various U. S. centres:

Chicago.—Following a period of dullness the market has improved considerably both in the steel and iron divisions. The movement has been helped by dealers covering their contract requirements. There is little railroad scrap offering.

Boston.—The demand is light and the feeling is towards a decline in prices. Scrap prices have dropped on the various grades from 25 cents to $1 during the past week. No 1 machinery is still good and some textile machinery was sold at $46.70 delivered to the Western part of the state.

New York.—The market has been unsettled, there being both advances and declines in prices of scrap material. Heavy melting, machine shop turnings, and clean cast borings dropped from $1 to 50 cents. Stove plate, wrought pipe and city wrought moved up a little.

Philadelphia.—The market is generally easier on steel, wrought, and machine shop turnings. A round tonnage of steel scrap was sold for $24 delivered, not much trading being done.

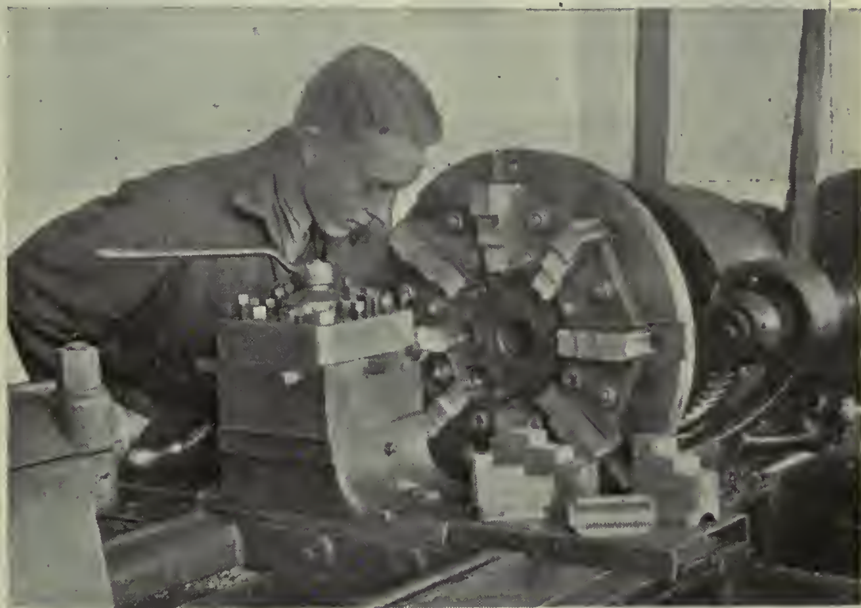
Pittsburgh. — Freight congestion is holding up shipments of material and is preventing shipments being taken in by melters. Under these conditions steel scrap prices have eased off somewhat. Heavy melting has ranged between $26.50 and $29. The latter is not usual, and probably $28.50 represents the normal price just now.

CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Vol. XXIII, No. 14 — April 1, 1920

The Evolution of the Dominion Chuck

—By J. H. Moore



READERS of CANADIAN MACHINERY will no doubt recall two articles published last year on the making of 5 in. naval gun mounts at the plant of the Dominion Steel Products Co., Ltd., Brantford, Ont. In these articles we not only commented on the intricacy of the work being accomplished but also upon the close limits to which the gun mounts were held.

It may seem strange that we should direct attention to an incident which is now a thing of the past, but we do so in order to illustrate the benefit and experience derived by this firm from the working on such a war-time product.

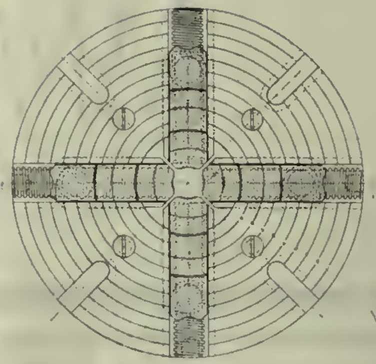
It may be surprising to know that these gun mounts were held to 1-10,000 limits. This gives a fair idea of the wonderful accuracy necessary on the work, but when we state that the company also turned out torpedo destroyer shafting for the United States Government, and enough propeller shafting in 1918 for 930,000 shipping tonnage, one can realize the magnitude of their task. All this work necessitated the use of a great number of chucks. But experience proved that at the most inopportune time these chucks would break, or crack, rendering them useless, causing considerable and costly delay in production. As Mr. Fischer, the sales manager, put it: "We were heartily sick of the complete performance, and solemnly vowed that we would build a chuck strong enough to stand the wear and tear of our business. We designed such a chuck, not with the sole idea of placing it upon the market, but because necessity once more proved herself to be the mother of invention. We had contracted to turn out shafts with no interruptions, and to do this we had to use chucks capable of standing the hard and steady usage we were giving them. Thus we decided to build our own."

The method used by this concern in the designing of the chuck is well worthy of note. They announced to the employees their determination to make chucks for their own use capable of standing the strain, and asked for suggestions. Of course when experienced operators are asked to give the benefit of their experince in a regular manner such as this, they feel it a privilege to do so. The result was, that many helpful suggestions were made and adopted. The metallurgist came forth flat-footed and stated what, in his opinion, was the correct properties of the metals best suited for such a chuck, and these were also acted upon. Last but not least the engineering staff got busy, with the result that between the employer, the metallurgist, and the designers, they turned out a chuck that stood the strain. All this did not come as easy as it looks on paper, but there was great satisfaction at the finish in knowing they had accomplished their purpose.

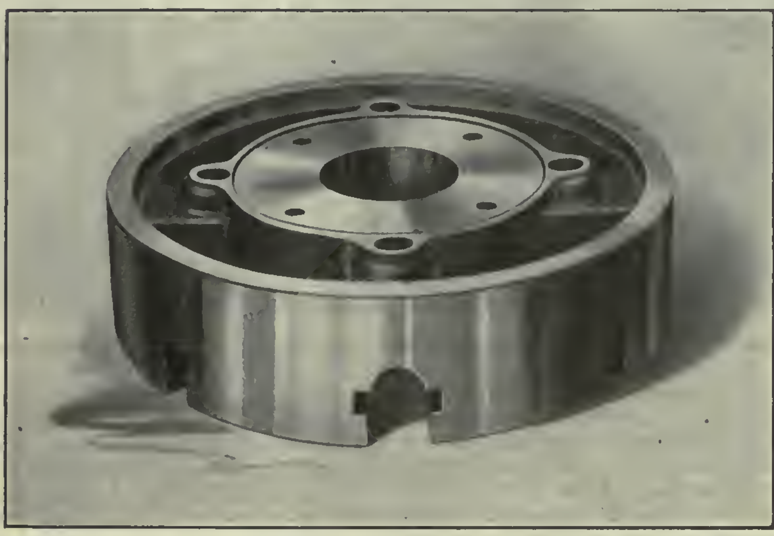
Then the war came to its dramatic close and the urgent need of gun mounts was over for the time being. The next problem was to start a peace-time industry, yet make that industry the turning out of some product that would fill a long-felt want. They decided to keep on with their large work on the marine steel shafting, and added to this line considerable work on rubber mill rolls, rolling mill equipment, and so forth, but in addition to these lines they decided to give the trade the benefit of their experience and place on the market their proven chuck, which was to be known by the name of "Dominion" 4 jaw independent chuck.

People are too apt to take a chuck for granted. As one machinist hesitatingly remarked on being asked what a chuck was, "Why—a chuck—a chuck is something that holds a piece of work you want to machine, or turn. Oh, anybody knows what a chuck is!" Strange to state very few people realize the importance of a chuck. In all his description of a chuck this machinist omitted to emphasize the necessity of accuracy. A chuck could hold a product and yet not be a good chuck. To belong to the A1 class it must have several features. First and most important of all, it must be accurate. A chuck that is not absolutely correct is worse than useless. Then it must be of strong and rigid construction, heavy enough to withstand unlooked for strains. Last, but as im-

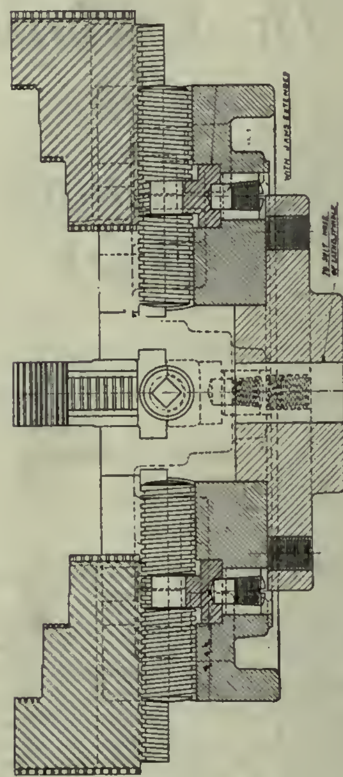
GENERAL VIEW OF THE CHUCK.



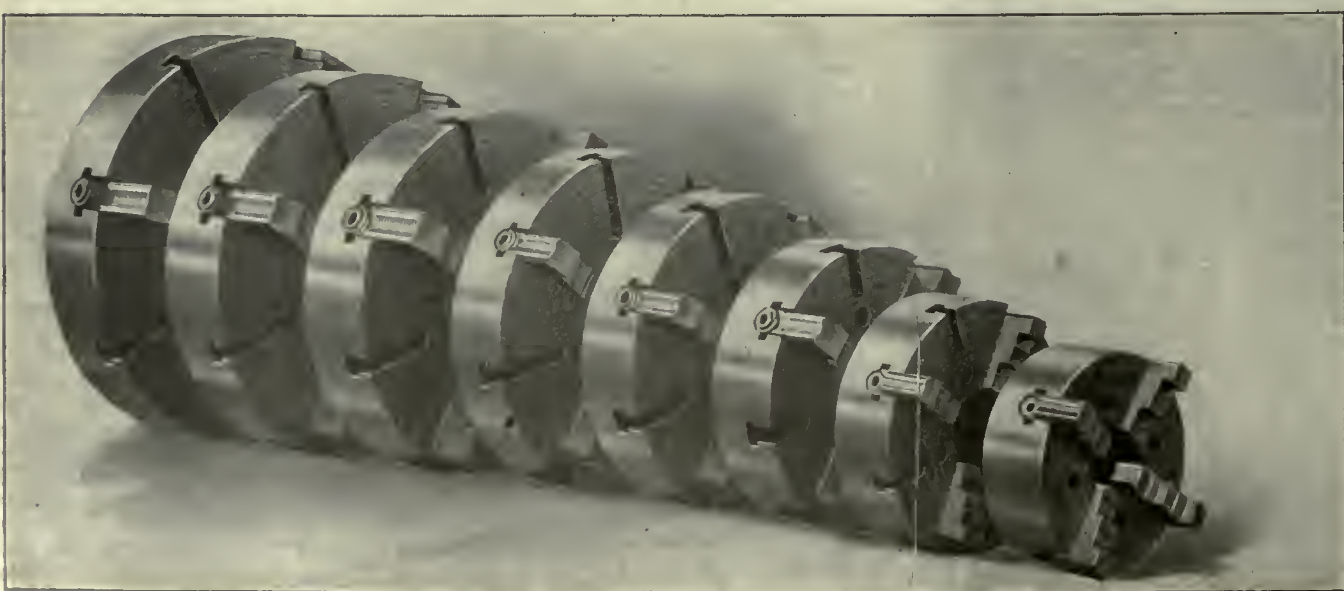
DIRECT FRONT VIEW OF CHUCK.



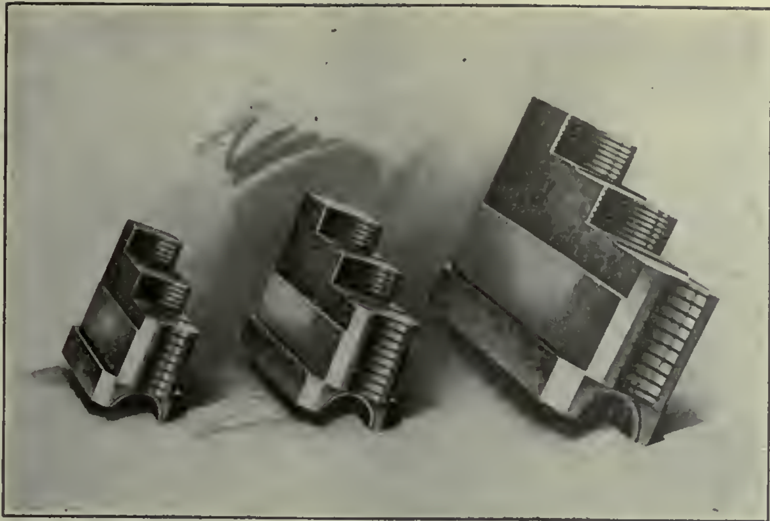
THE BODY OF CHUCK LOOKING FROM THE BACK.



SECTIONAL VIEW OF THE CHUCK.



GROUP OF CHUCKS FROM 10" TO 24" SIZE.



COMPARATIVE VIEW OF VARIOUS SIZED JAWS.

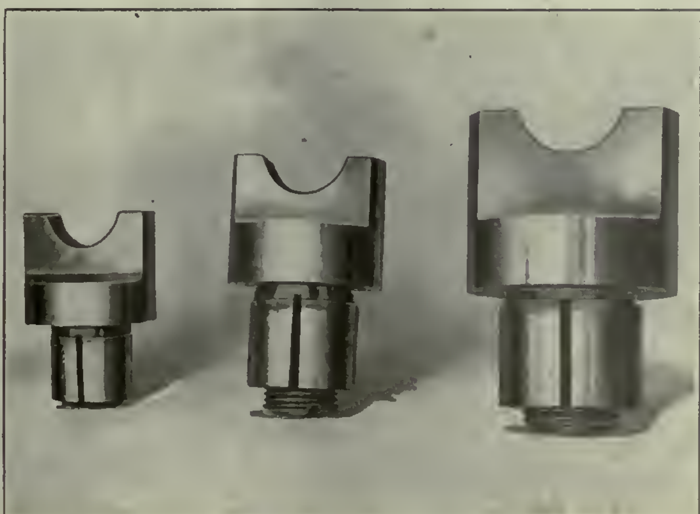
portant as any—it should be made in such a manner that its parts are interchangeable. This, unfortunately, is a feature often overlooked or passed up as an unnecessary precaution.

Having decided to manufacture chucks for sale as well as for their own use, the next step was to make sure that all the features of their already tested chuck went into their standard lines. Now came the point of deciding the sizes to be made, and once more they drew from their personal experience. Having used all sizes from 10 in. up to 24 in. themselves they decided to place a similar range of sizes on the market. They also made up their mind to play safe regarding strength, with the result that they decided to divide their chucks into three groups as follows: First, the 10 in. and 12 in. size; second, the 14 in., 16 in., and 18 in. size; third, the 20 in., 22 in., and 24 in. size. This meant that the proportions of the jaws and screws on each of these groups would be so designed that they would be heavy enough for the largest size in the group.

For example, the 10 in. chuck jaws and thrust blocks are the same size as those on the 12 in. chuck. The chuck screws on the 10 in. size are also the same size as the 12 in. chuck, the only difference being that of length. The chuck jaws of a 10 in. chuck could be taken out of that size and used in a 12 in. size, or vice versa. The same conditions hold good in all three groups, so that the 20 in. size chuck actually has jaws, thrust blocks, and screws, capable of standing the class of work performed on the 24 in. size.

It will be seen from this description that the feature of absolute interchangeability has also been embodied, for otherwise it would be impossible to substitute jaws from one size chuck to another. This decision to have all parts interchangeable meant large expenditure on the part of the firm, but as they themselves put it, "We have proved the feature of interchangeability to be well worth while and worth the added cost in jigs, fixtures, gauges and other equipment." The writer personally saw these fixtures, gauges, etc., and could not help but notice that considerable money had been spent in the perfection of their product.

MILLING THE CHUCK BODY FOR JAWS.



VIEW SHOWING HE THRUST BLOCKS, WITH EXPANDING STEM.

Types of Chucks Made

Before going into the actual manufacture, it might be best to mention that both grey iron and steel bodied chucks are made. While each are equally capable of performing their respective duties, it goes without saying that the steel chuck is superior. The day of the steel bodied chuck is here to stay. As every machinist of experience knows, the introduction of high-speed steel into the machine industry made many changes. Machine tools were practically redesigned to withstand the extra speed and strain, so that it was only natural that the steel bodied chuck followed. Unfortunately, however, there is still existent that type of individual who cannot see further than the initial cost of either a machine tool or chuck. They cannot

VIEW SHOWING THRUST BLOCKS AND SCREWS. NOTE THE REVERSIBLE FEATURE OF THESE SCREWS.

seem to grasp that a slightly greater expenditure at the start means a greater production, and of course larger profit in the long run. Fortunately this type is dying out, and manufacturers in general are alive to the advantages of the steel chuck for heavy strains. As we remarked at the start, however, this concern turns out both styles, grey iron and steel.

They mould their own castings, and in every case only first-class castings are allowed to pass. A blow hole is never tolerated, and any flaw in the metal sends the casting to the scrap heap. To illustrate the general design of the chuck we show several views, and call attention first to the picture illustrating the body of the chuck itself. It will be noted that it has both broad and deep T-slots, and is provided with a good thick section between the face of the chuck and the bearing surface of the Tee. It is this feature of design that allows it to stand up under increased stress. The other views illustrated will be taken up in due sequence, but having commenced at the body, let us follow it through the process of manufacture.

The Body

The first operation on this portion is that of rough-turning the outside diameter. It is now turned around and rough-turned down the back, also recessed to suit the face-plate. The next step is to finish turn the points just mentioned.

The third operation consists of drilling the holes for the face-plate, this work being accomplished in a special jig for the purpose. The face of the chuck is next finish-turned, also the outside diameter.

The fifth operation is an exceedingly important one, and we have illustrated it in picture form. This operation consists of rough and finish milling the jaw channels, also the milling of key slot. A special indexing fixture is used on the millers, which is so arranged that it locks itself every 80 degrees. Referring to the photograph, we notice that the form cutter is just about to pass through the second portion of its cut. By milling in the manner shown they are absolutely certain that every jaw will be at right angles to each other, for a sliding key locks itself into a slot on the circular table of the milling fixture every 90 degrees. This fixture, of course, as can be readily understood, swivels from the centre.

After passing through this operation the body goes to be broached. It might be well to explain that in the previous milling operation the jaw channels were not finished to size, but to wthin five-thousandths of the proper dimensions. It is this five-thousandths that the broaching operation removes.

We illustrate this broaching operation, and in the photograph will be noticed several other broaches used on the various-sized chucks. Briefly, two broaches are used on each size chuck, the first broaches the width of the channel, also the T-slot bearing surfaces, while the second broach is so arranged that guide portions fit the parts already broached, while a circular broach finishes out the chuck screw semi-circular guide.

After this has been completed the body passes on to the drill press and is drilled for the thrust blocks. This operation is also accomplished by means of a special jig.

Taking it for granted that the other portions of the chuck are completed, the next operation is that of assembling, but before going to this step suppose we consider the different operations on the making of the jaws.

Chuck Jaws

As can be readily understood, these jaws, to be efficient, must be made of good material. This is something which this firm can safely crow over, for all jaws are drop forgings of a special grade of steel, made to their own specifications.

The first operation performed is that of milling the bottom, after which the jaws are turned on their side, placed in a special holding fixture, and milled by a three-step cutter. As soon as one side is milled they are turned over and the other side likewise treated. A feature of the fixture used, and in fact all their milling fixtures, is that everything is governed by the T-slots in the miller table, so that the fixture, jaws, etc., cannot help but be in line.

The third operation consists of milling both ends of jaws at the same time. This necessitates a special form cutter which not only mills the form at both ends, but the bevelled portion as well.

The next and fourth operation is shown in picture form. This illustrates the milling of the groove in which the thread is cut at a later operation. The type of fixture can be clearly noted, and both a roughing and finishing cut is made to ensure accuracy.

The fifth operation is that of milling the undercut, or clearance space at both ends of the jaw. The serrations are then cut at the end of jaw, after which, by means of a special hob (guided in a fixture for the purpose), the threads are hobbed to suit the chuck screw.

The turning of the jaws is next in sequence, and five tools are used at one time for this operation. The tools are arranged in multiple form, and so spaced

BROACHING THE JAW SLIDES ON CHUCK.

TURNING THE CHUCK SCREWS. NOTE THE SQUARE HOLE ATTACHMENT IN PLACE.

that they cut the various steps necessary in the jaws. A special turning fixture is used which holds eight jaws at once, the work being tightened by the clamps as shown on the photograph illustrating this operation.

All burrs, sharp corners, etc., are now removed, in other words, each jaw is gone over separately and touched up to ensure that no corners or objectionable burrs remain. The next step is that of hardening, and the jaws are bone-hardened to a depth of 1-16th of an inch. Before proceeding with the last operation, which also enters the assembly stage, we will consider the work entailed in the manufacture of the thrust blocks.

The Thrust Blocks

It is a recognized fact that the thrust block of a chuck is a part which must be carefully watched in order to secure accuracy. Special jigs have been designed to guarantee this point, and following is the sequence of operations:

The blocks are first turned on their outside diameters. They are next drilled and tapped to receive the tapered headless set-screws, which expand the stem when required. The ends are now faced, the sides straddle milled to definite size, after which two blocks are placed at a time in a special jib and the semi-circular hole which receives the chuck screw is drilled. The slots for expansion are next cut into the stem of the block.

They are now ground on their outside diameters, and on their two sides, which have previously been straddle milled, after which they are bone hardened. This completes the operations on this portion of the chuck.

The Chuck Screws

We will next consider the chuck screws. These parts are practically finished on the automatic lathe, the first operation being the rough-turning to within 1-32 in. of size as regards outside diameter. The clearance for thrust block is also roughed out at this operation. The square hole in each end of the screw is also drilled in this set up by means of the now well-known square hole attachment. Instead of the attachment being placed vertically, as in a drill press, it is placed horizontally as shown in the photograph.

The screws are now finish turned on special square centres, a mark being made on each screw to show how it was placed on the centres in order to ensure their being placed in similar position when being threaded. This threading operation is next in sequence. The screws are then finished to meet exact width as far as the centre portion is concerned, that is where the thrust blocks fit into.

A commendable feature on these screws is the fact that they are reversible. For example, suppose the square hole in one end of the screw becomes damaged and unfit for use. One need not worry, for all they need do is to reverse the screw and use the hole at the other end. This is one case where interchangeability cannot help but shine. The screws are absolutely similar on both sides of the thrust block, otherwise they could not be used in the manner described.

After the finishing operation to suit thrust blocks, all burrs are removed. The screws are next hardened and polished. This, of course, is the final operation.

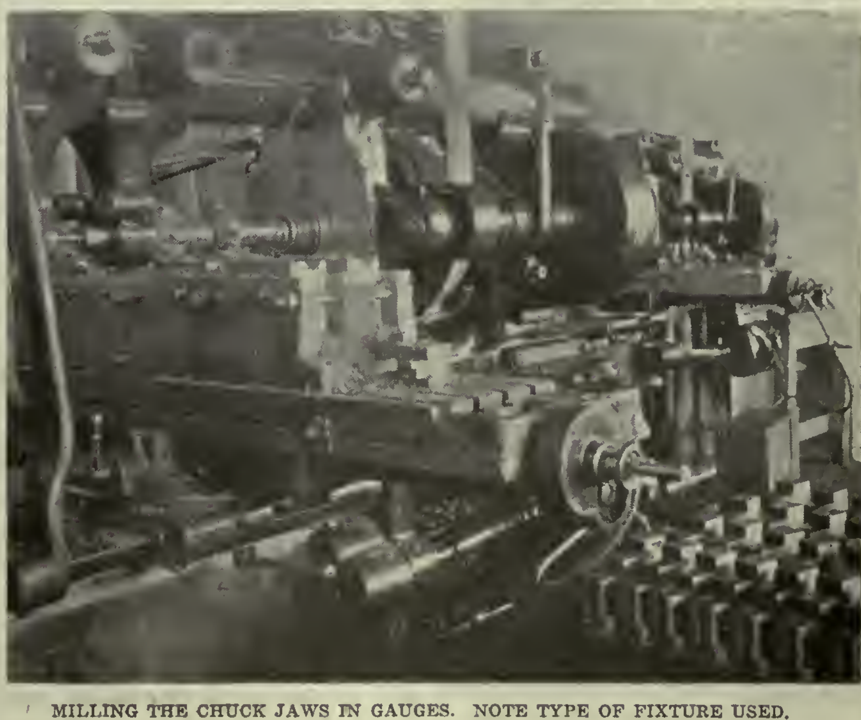
The two remaining parts, namely, the wrench and the headless taper set-screw for expanding the stem on the thrust blocks, are straight machine work, so no detailed comment is made. Having covered the main details of construction, let us proceed to the final assembly and inspection.

As shown in the illustration this assembling takes place on long benches. The chucks move up from one workman to another by steady stages. Each worker has his set task, with the result that by the time the chuck reaches the other end of the bench it is assembled, inspected, and ready to pack for shipment. The last worker on the bench packs the chucks in their cases, stencils the boxes, and piles them up on the truck, which later takes them to the warehouse.

It will be noted throughout the article that every step in the progress of manufacture has been carefully weighed in order to eliminate lost motion. The experience gained on their gun mount work stood them in good stead in the manufacture of this chuck, for having once mastered the matter of proper routing and working to close tolerances, a firm never lets go, for they realize its many advantages. This we can safely say without taking away any credit from the executive staff of the concern mentioned, that the high point in efficiency reached by them has been indirectly obtained by former war-time experience.

A notable feature in connection with this chuck is that the company issue with every chuck a one year guarantee, part of which reads as follows:

"We could make our chucks cost less



MILLING THE CHUCK JAWS IN GAUGES. NOTE TYPE OF FIXTURE USED.

if we chose to be indifferent as to quality. This, however, we will not do. We have set ourselves a high standard and are determined to live up to that standard. We believe, judging by our own experience, that there is a big and growing demand for chucks of superior design and quality such as we offer. Consequently we fully guarantee every chuck we sell. This guarantee applies both to material and workmanship. Any part of any of our chucks that is found to be defective within one year after purchase will be instantly and cheerfully replaced without charge."

Need we say more? When a firm speaks so convincingly and confidently regarding their product, it is a sure sign that both the material and accuracy of workmanship is embodied therein. The various illustrations accompanying this article give better details of the chuck's general design than text matter could ever accomplish, so we leave the reader to study the improvements embodied in this Canadian made product.

VIEW SHOWING A PORTION OF ASSEMBLING DEPARTMENT.

Pyrometers and Steel-Treaters*

By T. G. SELLECK

All modern steel treaters appreciate the value of thermo-electric pyrometers as a means of determining high temperatures, and they are in use so generally that it is a rare experience to find a steel treating plant that is not so equipped. The value of pyrometers depends, however, entirely upon the intelligence displayed in their use and the care with which they are kept standardized and calibrated. In the hands of ignorant operators they are as likely to lose their value as a full-jeweled solid gold watch would be in the hands of a chimpanzee, and to become an expensive nuisance rather than a valuable help. Yet it is not uncommon to find them being used by men that call themselves steel treaters, but who have no knowledge of the principles of construction and operation of pyrometers or of the care required to keep them in working order.

The fault lies, of course, with the employer. No employee should be trusted to use a pyrometer until he has been given some information concerning its construction, its principle of operation, and its delicacy of adjustment, as well as its limitations of accuracy; and unless he has the mental capacity to grasp these things the instrument might better be kept away from him.

The full value of a pyrometer is obtained only in the hands of an operator whose knowledge of steel treating includes a conception of temperature as indicated by color tints. This is essential because the pyrometer gives the temperature of only a small area within the furnace and the true temperature of a heating chamber can be judged only by comparing that area with the remainder of the chamber on the basis of the colors shown. It is not unusual to find men using pyrometers to whom "heat by color" means nothing.

To such men the pyrometer is a sort of wonder-instrument that tells the whole story of temperature and don't even have to be wound up. Here is a case in point:

Not long ago I was called to a certain plant where some case-hardening had been done that was not satisfactory, and the owners wished to know the cause of their trouble. The parts carbonized were discs about four inches in diameter and ¼ in. thick. Upon examining them I found that they had been carbonized entirely through and were badly fused on the edges. The operator that had done the work informed me he had carried a temperature of 1600° for 5½ hours.

I asked if he was sure of his temperature, and he said yes, because his "byrometer" registered just 1600°.

I suggested that there must be something wrong with his "byrometer," since it would be impossible to fuse 20-point carbon steel at 1600° Fahr., and quite as impossible to carbonize the pieces to the saturation point in that period of time at such a temperature, to which he replied: "Well, maybe it does need fixing, but I have used it several years, and aint had no trouble before."

I prevailed upon him to have his outfit checked, and learned later that the temperature carried was high enough to fuse a hole through the top of the plate steel box used to pack the parts, and also that, while the instrument was in good condition, the thermo-couple had been broken near the hot junction and that the elements had been twisted together and used without being welded.

In such a case, which is not unusual, the man is in as great need of being checked and calibrated as the instrument, and a superintendent who would trust results in a steel treating department to a man so lacking in the simpler essentials of steel treating, namely, common sense and watchfulness, should also be sent out to be "fixed."

In another plant where trouble developed, conditions of another nature were found. Here the men on the job were "highly intelligent." The works manager was a college graduate, well versed in metallurgy, and his steel treater a man of more than ordinary intelligence and some years of experience. The cause of complaint was a lack of uniformity of hardness after parts had been carbonized and heat treated. That is, there was a variation of 10 points scleroscope when the parts had been given uniform heat treatment, where the allowable variation was only three points (from 77 to 80). Investigating their methods of carbonizing, it was a wonder that the variations did not exceed 10 points. The carbonizing boxes were packed in the regular way, placed in a cold furnace, and the temperature raised as rapidly as possible to 1800°. The thermo-couple, unprotected, was placed in the furnace through a top-vent about the centre of the heating chamber. The furnace temperature was maintained at 1800° for three or four hours, the fire shut off, and the boxes allowed to cool with the furnace. With technical knowledge and years of experience in the work, these men use the pyrometer with but little more judgment than the poor ignorant fellow whose "byrometer" had been such a faithful friend to him for so many years that he had no idea the little matter of a broken couple could make any difference.

In one spot of the furnace they probably had 1800°, and that was the very hottest spot in the furnace, while other parts of the heating chamber probably varied in temperature much more than the product varied in scleroscope hardness. Working within narrow limits of hardness and tempting fate with reckless heating, indicates the need of "calibration to the job" for even intelligent experienced men.

*Abstract from "Journal" of the American Steel Treaters' Society.

The Work of the British Trade Commission

Seeking to Promote Trade Within the Empire—How Canadian Firms Can be Helped by This Organization—Analyzing Marketing Chances is a Very Helpful Service to British Firms

"ONE of the outstanding features of the commercial and industrial situation is the tendency of the various units of the British Empire to trade one with the other," said Mr. F. W. Field, British Trade Commissioner in Ontario, in an interview with CANADIAN MACHINERY. "This is a most interesting development, and if the policy is given the support and encouragement it deserves the volume of trade within the British Empire will grow to considerable proportions. In Canada the business community are not entirely familiar with the raw materials, semi-manufactured and manufactured products which can be secured in other parts of the Empire. While the desire is naturally first to purchase in Canada, it is equally the wish to purchase whatever possible in the United Kingdom and the British Empire generally.

"Manufacturers and traders in the United Kingdom are turning the channel of their purchases of raw materials and some manufactured articles from foreign countries, to Canada and the other Dominions. During the past year, this country has benefited by several such arrangements. The work of trading within the Empire is being encouraged by the British Government's trade commissioner service, in connection with which have been opened more than a dozen offices in the Dominions and in India. The Canadian Government trade commissioner service is also extending to various parts of the Empire. We appear to be on the eve of an important development of trading within the Empire, a development fraught with immense possibilities.

"The British Government trade commissioner service in Canada comprises three offices, one each at Montreal, Toronto, and Winnipeg. An office may be opened at Vancouver in the near future. A British Government trade commissioner stationed in any Dominion or colony, and responsible for a particular area, has to make himself fully conversant with:

1. The business houses trading in this area, as well as the local manufacturing and public bodies.
2. The quantity and value that the country purchases of any articles which the British manufacturer and merchant can supply.
3. The tariff and customs regulations for goods entering the country.
4. The foreign goods competing with British, their method of sale, their character and price.
5. Freights and charges and the comparative rates between British ports and foreign ports serving his area.

"All these categories of information are essential to any British exporting house, and an important function of a trade commissioner is to obtain precise details with regard to them. For instance, take category (1); these concerns consist, as they do in Great Britain, of:

(a) Importing merchants — generally wholesalers, though in some instances they are retailers.

(b) Local manufacturers who are importing machinery, material or equipment.

(c) Local agents who import buying for their own account, some with an exclusive right to serve a particular market as well as agents acting on commission.

(d) The big railway corporations, municipalities and public works, as well as agents acting on commission.

(e) Mining companies carrying on mining and other similar operations, who are also large buyers; and

(f) Shipping companies, telegraph companies and wireless companies, who are also considerable importers from time to time.

"The trade commissioner works in close touch with the Government of the territory to which he is attached, and with resources at his disposal he is able to obtain considerable information about all classes of importers.

How It Works Both Ways

"Every exporter wants to know the extent to which an Empire market purchases goods which the United Kingdom can supply. In order to furnish an answer the commissioner must analyze the figures of trade so that articles may be eliminated in which business would be highly improbable. The local market has to be scrutinized from two points of view:

1. What manufactured articles the British manufacturer can supply.
2. What entrepot trade can be done by British merchants in articles such as plumbago, spices, rubber, tea, coffee, sugar, etc.

"While the primary duty of the British trade commissioners is to ascertain what opportunities exist, and by what means these opportunities can be best utilized for extending in their area the trade of the United Kingdom, and of those other parts of the Empire which desire to utilize the service, the British Government has instructed the trade commissioners to regard it as their general duty to endeavor to promote the trade of the British Empire as a whole within the area to which they are appointed.

"Many organizations are working with a view to closer Anglo-Canadian trade relations. In addition to the Canadian trade commissioners in the United Kingdom there is the Canadian Trade Mission. The Federation of British Industries, representing approximately 19,000 United Kingdom firms, has effected an arrangement with the Canadian Manufacturers' Association for the interchange of views and information. The British Agents' Association with offices at Montreal has for eighteen years been doing good work on behalf of British trade in Canada. During the past year the Canadian Association of British Manufacturers and their representatives was formed with the assistance of the British Trade Commissioners in Canada. This association, with branches at Toronto and Montreal, represents a large number of United Kingdom firms trading in Canada and has done effective work even in the early stages of its career.

"The Canadian Government has accepted the offer of the Imperial Government and will utilize the service of the British trade commissioners at points where there is not a Canadian Government trade commissioner. The Government of India have expressed a desire to avail themselves of the services of the British Trade Commissioner Service in Canada as well as in other parts of the British Empire. Further, the trade commissioners will be willing to assist importers seeking sources of supply of raw materials, etc., within the Empire.

"The Trade Commissioner Service in the Dominion can only justify itself in proportion to the extent to which it is used by those interested in the development of trade between the United Kingdom, Canada, and other parts of the British Empire."

IT WAS A GOOD NAME AT THAT

In an Irish city a zealous policeman caught a cab driver in the act of reckless driving. When he had brought the man to a stop the officer asked:

"What's your name?"

"Ye' bethher try and find out," was the peevish response.

"Sure an' I will," said the officer as he went round to the side of the cab where, according to the Irish regulations the name should have been painted. The letters had, however, been rubbed off.

"Oh, ho!" cried the policeman. "Now ye'll git yourself in worst than iver. Your name seems to be oblitherated."

"Tis not so!" shouted the driver indignantly. "Tis O'Sullivan."

It is hardly believable that it costs $2,000,000 annually to remove the snow from the streets of New York, also that millionaires are nearly three times as numerous in the United States to-day as they were in 1914.

Canadians Looking for Export Business

Several Points That Should be Remembered in Connection With Forwarding Goods—Much Business in Hand Makes it Harder for Canadian Firms to Make Bid for Export

THE work of rounding up Canadian manufacturers who are going to be represented at the Canadian Industries Exhibition, London, Eng., June 3 to 17, is meeting with considerable success. Mr. O. C. Pease is Canadian representative of the exhibition, and has visited nearly all the industrial centres.

Some of the Canadian industrial concerns find it hard to consider an exporting propaganda. They have so much business in sight that it is impossible for them to keep pace with their delivery schedule. Others, though, are looking forward to the time when the order of things may be reversed, and when they may be more keen on booking business than they are at present.

Mr Pease has issued the following instructions to the Canadian exhibitor in regard to sending his goods to London. There is considerable material in the letter that it would be well for Canadians contemplating export to put away for reference. It is necessary that the customs details should be adhered to very closely if there is to be as little delay as possible in getting the material over. The instructions are as follows:

Insurance

Shippers should specify what clauses they require in insurance, whether marine, F. P. A. (free against partial loss, a cheaper rate), or F. P. A. 3 per cent. package or shipment.

Forwarding

Owing to the formalities of export shipping, it is to be understood by shippers that a contract number for space, and a permit number for transportation, have to be obtained from steamship and railway companies, and which should be shown upon all shipping papers. This information will be obtained by Morison, Pollexfen & Blair, and forwarded to each shipper for guidance.

The company of Morison, Pollexfen & Blair, has been chosen by the Canadian Manufacturers' Association and the exhibition management to take care of all shipments placed in their charge by intending exhibitors. The Morison Company is one of the best of the English forwarding houses, has been established in the United Kingdom for over sixty years, and is thoroughly well represented in Canada.

In brief, the Morison Company will collect all material and assemble it at the Port of Montreal. The company will then remark all packages and crates and arrange for the shipment of all material in one consignment. This one consignment will be shipped to the Morison Company at the Royal Agricultural Hall, Islington, London, Eng. The goods will arrive at the point of destination on or about the 24th of May. For the information of shippers who are handling their own consignments, I may say that the hall will be open to receive shipments on and after May 20th.

Your company's representative in England will thus be able to proceed direct to the representative of Morison, Pollexfen & Blair at the hall, and on payment of all shipping charges and transportation costs, etc., will be able to obtain a release of your exhibition material and proceed at once upon the arrangement of your space contracted for.

Exhibitors who intend to place their shipments in bulk consignment must advise Morison, Pollexfen & Blair just as quickly as possible, so that the latter may make full arrangements regarding ocean space. A knowledge of the weights, measurements, etc., of shipments is of course absolutely necessary.

The Morison Company of Montreal and Toronto offers every facility they have to inexperienced shippers, and I suggest to the latter that they utilize the services of the forwarding agents to the fullest possible extent.

Yours very truly.
O. C. PEASE ,
Sole Canadian Representative.

Instructions Re Shipment of Exhibition Material

If you have not already advised me regarding the value, weight and cubic capacity of your intended shipment, kindly send this information at once to Morison, Pollexfen & Blair of Canada, Ltd., 308 St. Nicholas Building, Montreal, P.Q. Shippers in Ontario and the West should send this information to Morison, Pollexfen & Blair Toronto office, 301 Tyrrell Building, 95 King Street East, which office will look after all details and supply all necessary information to Western shippers.

Canadian Consignment

All exhibition consignments must be forwarded to Morison, Pollexfen & Blair, 308 St. Nicholas Building, Montreal, P.Q., timed to arrive at that point not later than May 3. Responsibility in this matter rests entirely upon the individual shipper. Information and assistance in this respect may be obtained, however, from either the Toronto or Montreal offices of Morison, Pollexfen & Blair.

Crating and Marking

All exhibition material must be carefully and strongly crated. Each case should be marked addressed to Morison, Pollexfen & Blair, Montreal. Each case should bear the following marks:

Distinguishing shipping mark (if I were shipping, for instance, I would mark each case O. C. P. No. 1, 2 and 3, etc.).

Gross and net weight of each case.

Dimensions of case.

Shipper's name.

This information should be shown on at least two sides and one end of each case.

Invoices

Invoices in duplicate should be sent to Morison, Pollexfen & Blair, Montreal, showing the net value of contents of whole shipment—this for insurance and statistical purposes.

Charges

All inland freight charges must be prepaid by the shippers, including handling charges, cartage, dock dues and wharfage.

If you wish to forward "Ocean Charges Collect," please notify Morison, Pollexfen & Blair. The forwarding company can arrange this and collect from your representative at the Royal Agricultural Hall.

It is to be pointed out that the prepaying of ocean charges is to the advantage of the shipper owing to the exchange situation.

Up to this date the following is a complete list of the Canadian exhibitors:

The Bell Piano & Organ Co., Ltd., Guelph, Ont.
Chase Tractor Corporation Ltd., Toronto.
Hill, Seddon & Co., Toronto.
Sales Limited, Toronto.
White Swan Spices & Cereals, Ltd., Toronto.
H. Levy & Sons, Ltd., Montreal.
The Basque Chemical Co., Toronto.
Non-Such Mfg. Co., Toronto.
Satinette Products Mfg. Co., Toronto.
Normandy Tire & Rubber Co., Toronto.
Smalls, Ltd., Montreal.
J. B. Heeble & Sons, Ltd., Toronto.
Megantic Broom Mfg. Co., Lake Megantic. Que.
Meakins & Sons. Ltd., Hamilton.
Stratford Mfg. Co., Ltd., Stratford.
Schultz Bros., Co., Brantford.
Canadian Veneering Co., Actonvale.
Springer Lock Mfg. Co., Belleville.
Gavenite Products, Ltd., Toronto.
Canadian Woodenware Co., St. Thomas.
Kindel Bed Co., Ltd., Stratford.
McLagan Furniture Co., Ltd., Stratford.
C. A. Dunham Co., Ltd., Toronto.
Willard's Chocolates, Ltd.. Toronto.
Canadian Polishes, Ltd., Hamilton.
Dominion Machinery Co., Toronto.
Staunton's, Ltd., Toronto.
Maxwells. Ltd.. St. Marys.
Quebec Graphite Co.. Ltd., Ottawa.
C. H. Peters' Sons. Ltd., St. John, N.B.
The Breithaupt Leather Co., Ltd., Kitchener.
Acadia Gas Engines, Ltd., Bridgewater, N.S.

Canada Cycle & Motor Co., Ltd., Toronto.
Deloro Smelting & Refining Co., Ltd., Deloro.
The Cowan Co., Ltd., Toronto.
A. Ramsay & Son Co., Montreal.
Canadian Biscuit & Confectionery Export Co., Ltd., Toronto.
The Export Association of Canada, Ltd., Montreal.
Canadian Bronze Powder Works, Ltd., Montreal.
The Whitman & Barnes Mfg. Co., St. Catharines.
The Williams Piano Co., Ltd., Oshawa.
The Steel Co. of Canada, Ltd., Hamilton.
Simmons, Ltd., Montreal.
Spramotor Co., London.
Imperial Varnish & Color Co., Ltd., Toronto.
J. H. Connor & Son, Ltd., Ottawa.
Tetreault Shoe Co., Ltd., Montreal.
Wettlaufer Bros., Ltd., Toronto.
The Maple Tree Producers' Association, Ltd., Montreal.
Nova Scotia Steel & Coal Co., Ltd., New Glasgow, N.S.
C. O. Clark & Bro., Montreal.
C. J. Bodley Co., Ltd., Toronto.
The McCormick Mfg. Co., London.
Robertson Bros., Ltd., Toronto.
The Martin-Orme Piano Co., Ltd., Ottawa.
The McClary Mfg. Co., Ltd., London.
William Neilson, Ltd., Toronto.
Sherlock-Manning Piano Co., Ltd., London.
Ottawa Paint Works, Ltd., Ottawa.
The Goodyear Tire & Rubber Co., Ltd., Toronto.
The Kitchener Export Association, Kitchener.
Sheet Metal Products Co., Ltd., Toronto.
E. T. Wright & Co., Hamilton.
Massey-Harris Co., Toronto.
International Harvester Co., Ltd., Hamilton.
C. P. R. and C. P. O. S., London, England.
Canadian Government Merchant Marine.
Reg. N. Boxer Co., Ltd., Toronto.
Shawinigan Paper Co., Ltd., Montreal.

EFFECT OF HYDROGEN ON IRON AND STEEL

German technologists have continued their researches since the armistice, one of these being the effect of various gases on iron and steel. The results suggest, says the London "Ironmonger," that if the gases could be conveniently and safely applied, some of them, and particularly hydrogen, might be employed with advantage in certain metallurgical operations, as in the cementation process of making steel and in refining and hardening. The use of hydrogen with iron at high temperatures, however, unfortunately is difficult and dangerous, apart altogether from its high cost, and it is not likely therefore that it will be used for any of these purposes en any commercial scale, though it may continue to be used for research. When that gas is forced through molten iron it is found that any non-metals present such as arsenic, carbon, phosphorus, silicon, sulphur or oxygen are converted into gaseous hydrides while the hydride itself in any particular case may be split up again and the nascent hydrogen set free, under which conditions it will reduce any silica present in the metal, even at so low a temperature as 1,292 deg. Fahr., the gaseous silicon hydride resulting.

From the practical point of view the most interesting of the results of this particular research lies in the revelation that a malleable iron may be made directly by means of oxygen and hydrogen, not only from molten iron but from solid pig. The inert character of nitrogen is confirmed by this research, that gas having no effect on the non-metals in iron, either in the solid or liquid state, notwithstanding the view very generally held that the carbon in iron will diminish if the metal be heated in an atmosphere of nitrogen, the real explanation of this diminution being the action of small portions of oxygen retained in the vessel with the nitrogen.

CARE AND STUDY NECESSARY TO DEVELOPING TRADE WITH CHINA NOW

TRADE COMMISSIONER ROSS, writing in the Bulletin, has the following reference to Canada getting trade with China:

Methods Necessary to Study

Assuming that we are really seriously desirous of developing trade with China, there are several points that are very necessary to understand and certain methods which must be followed. As it is now, Canadian manufacturers in many instances demand that business be brought to their doors; factory prices are asked and letters of credit demanded. In export trade such rules are very stringent, but would not be so bad if our prices were lower than those of other countries, but unfortunately such is not the case, but rather the reverse. Shipping and routes must be better understood by our people than at present, and at least quotations must be made f. o. b. Vancouver. Certain manufacturers in Eastern Canada have written that this cannot be done; it would seem that it should be the business of boards of trade to see that it can be done. It is very remarkable that exporters of Great Britain and the United States are able to quote c. i. f. rate Shanghai, and that Canadian manufacturers cannot quote f. o. b. Vancouver. Who is likely to get the business under such conditions? In respect to payments, letters of credit will not be given by certain firms; it is therefore necessary that a shipper should know his customer; much business is lost by this hard and fast rule of demanding letters of credit in every case. Many shipments of goods from Europe and America are consigned on time payment; this is not difficult when the shipper knows the character and standing of his customers.

In conclusion, unless more of our people will go to the trouble and expense of visiting this market and make a greater effort than they have hitherto done, our trade with China is not likely to greatly expand. Probably the greatest need of all, however, is that some Canadian commercial concerns should establish themselves in Shanghai, with branches in certain of the outports. At present Canadian goods have no distinct recognition in this market; the market is so vast and foreign goods so plentiful that the small quantity coming from Canada is never observed. There are no special advantages or preferences to be obtained by any country here; all are upon the same footing and receive the same privileges. The market is keenly competitive and every nation is represented. Nevertheless Canada enjoys some distinct advantages in the way of direct steamship connection, and if the right methods are followed should be able to hold its own among the others and to obtain a fair share of the developing trade of this great country.

The following "don'ts" from "Belting" should interest the mechanic in general:

"Don't attempt to stop a machine by grabbing the belt.

"Don't throw, by hand, a belt with which you are not familiar.

"Don't lean the end of a ladder against a moving shaft; rest the end on the stringer.

"Don't place a ladder between two shafts to adjust a belt; place it on the outer sides.

"Don't put on a belt without stopping the machinery, or at least reducing the speed one-half.

"Don't, when splicing a belt, leave ragged ends or projections that might catch in someone's clothing.

"Don't, when throwing off belts, allow two belts to occupy the same space between two pulleys on the driving shaft.

"Don't try to release an overhead belt that is caught and begins to wind around the shaft; get away from it and have the power shut off immediately.

"Don't leave any tools on the stringers overhead after having tightened the clutch fingers or parts of a countershaft, as the vibration will cause them to fall.

"Don't use a short pole when replacing an overhead belt upon a pulley that is in motion; use a pole nearly equal to the distance from the pulley to the floor."

Animal and vegetable oils both oxidize or gum on exposure to the air. Spread thinly over inflammable material, they will create spontaneous combustion. Linseed oil is an excellent example of gumming oil—highly desirable for paint but not for lubricating purposes. All seed oils have this common characteristic in greater or lesser degree.

The Electrolytic Production of Oxygen

This Paper Was Read Before the British Acetylene and Welding Association and Should Prove of Interest to Readers in General. Cost Items Are Left in Original State for the Sake of Comparison

By G. I. STANFIELD

THE subject of our paper is one which calls for a good deal of care, both in its preparation and perusal, as, owing to the enormous progress made in the oxy-acetylene welding and kindred industries, we have now come to a stage where the question of a cheap and certain supply of oxygen is of vital necessity to economical and efficient application of these processes.

It is somewhat difficult in a paper of this description to avoid the use of formulae, but, as far as possible, we will leave the more technical items aside altogether. These have not much bearing from the point of view of general interest, and, consequently, are only of importance to the individuals more concerned in the manufacture and installation of gas-producing plants.

As you know, oxygen may be produced from different substances, and the whole history in detail of the various methods of production, together with the successive steps leading up to our present-day output, is a most interesting study.

Oxygen gas is produced in three different ways, namely:—

i. By the chemical process.
ii. By the liquid air process.
iii. By electrolysis of water.

Chemical Process

In the chemical process, a mixture of manganese dioxide is mixed with other chemicals to form a slow-burning compound, and when this is ignited in a hermetically-sealed container, built to withstand high pressure, a fairly pure supply of oxygen is the result. The chief drawback to this method is the high cost of production, which precludes the application in a general way; but in special cases this type of oxygen generator is a valuable asset, and particularly in certain inaccessible parts of South America and Africa, where cylinders of gas are not readily obtainable, has extended the useful sphere of oxy-acetylene welding to a remarkable degree.

Liquid Air Process

The second means of production, namely, the liquid air method, is responsible for the major portion of our oxygen at the present day, and the manner in which the supply factories have been erected and maintained in close proximity to the main manufacturing centres is undoubtedly one main cause of the wide-spread usage of oxy-acetylene welding, etc.

The history of the liquid air plant is very interesting, indeed, and the story of the early pioneer research and later developments read almost like romance. Briefly, the discovery was due largely to one of the early physicists, who argued that as water by decrease of temperature is transformed to a solid, and by application of heat becomes a gas, that the converse law should apply to gases.

Pursuing this line of thought, careful experiments were made with chlorine, which is one of our most readily liquefied gases, the result proving to its delighted discoverer that his theory was correct.

For many years a number of the gases, including hydrogen and oxygen, defied all attempts at liquefaction, and were classified as permanent gases which could not be reduced to any other form. Improved apparatus utilized in the research, however, proved a great help, and step by step the definite goal of our present output of oxygen was achieved. Many set-backs, due to seemingly impossible barriers were encountered, but gradually, one by one, these were broken down.

Liquid air contains, approximately, 20 per cent. of oxygen and 80 per cent. of nitrogen, and other rare gases. The boiling point of liquid oxygen, being somewhat lower than that of liquid nitrogen, provides a means of separating the latter gas, leaving almost pure oxygen.

Electrolytic Process

This brief outline now brings us up to the main point of our paper, namely, the production of oxygen by electrolysis. The development of the electrolytic process has been carried out on the continent of Europe and in America to a greater extent than here. In all probability, the two factors causing this being the cheaper cost of electricity and the larger use of oxygen and hydrogen, the former in oxy-acetylene welding, and both in combination in oxy-hydrogen cutting, whilst the hydrogen alone has been largely used in treatment of fats in soap making and similar industries.

As early as the year 1800, it was discovered that in discharging a Voltaic pile through water, an evolution of gases took place at the electrodes, one electrode evidently producing twice as much gas as the other. Not much notice was taken of this at the moment, until someone analyzed the gases produced, with the result that water was found to be composed of H_2O; or two volumes of hydrogen to one of oxygen. No further notice was taken until about 80 years later, when D'Arsonval, requiring pure oxygen for certain research work, made a small and crude but efficient plant for the production of this gas. The commercial production of oxygen and hydrogen by this process was, however, not proceeded with for many years.

Meantime, a number of facts and details were established in connection with the electrolysis of water, one of which being the fact that a voltage of 1.7 (in round figures) was necessary to effect the decomposition. It follows from this that, in order to be successful, economical and efficient, any method of electrolysis must be as near the theoretical figure as possible, and many of our present-day plants have succeeded in producing the gases very economically indeed.

Another interesting item, worthy of note, is that 100 cubic feet of oxygen weigh 8.926 lbs., whilst 200 cubic feet of hydrogen weigh 1.118 lbs.; thus, one gallon of distilled water approximately produces 100 cubic feet of oxygen and 200 cubic feet of hydrogen.

A further point of great importance was brought to light as a result of experiment, namely, the fact that pure water is a non-conductor of electricity. It, therefore, becomes necessary to overcome this point, which can be done by adding acid to the water. The disadvantage of acid in attacking the electrodes forms a very serious impediment, however, and eventually alkaline solutions, which are comparatively harmless, unless containing chlorine, became generally used. The principal solutions are caustic potash, caustic soda, carbonate of potash and carbonate of soda.

Caustic potash forms an ideal solution in every way, especially for types of generators employing asbestos mesh screens, as these are not affected by the potash. The high price of the potash and difficulty in obtaining same in large quantities, however, forms a serious drawback to its employment on a large scale.

Caustic soda, on the other hand, is much cheaper, and is readily obtained in an almost pure state. It forms an ideal conductor of low specific resistance, approximately equal to caustic potash, but may rapidly destroy the asbestos screen, and cannot usually be utilized in connection with the plants requiring these diaphragms. From a handling point of view, it is terrible, as, used at a strength of about 30 deg. Beaume (or equal to a specific gravity of 1.27), it burns holes in one's clothes and boots to an alarming extent, and is particularly painful if in contact with the skin.

Great care is required in the mixing of the solution, therefore, and rubber gloves and boots are necessary to protect one somewhat against its ravages.

Pearl ash, or carbonate of potash, and carbonate of soda are frequently used, but are of a higher specific resistance than caustic soda and caustic potash, thus a large percentage of the voltage employed is wasted in overcoming the resistance, thereby detracting somewhat from the efficiency of the apparatus.

Various theories were formed as to the actual operations taking place during electrolysis, but it is now generally agreed that actual liberation takes place only on the face of the electrodes, whilst both gases follow the natural law of electro-magnetics.

Oxygen, being a negative gas, is always attracted and liberated at the positive pole or anode, whilst hydrogen, being electro positive, is liberated at the negative pole of the battery (or kathode).

Production of the gases is, in every way, a simple and natural function; the great difficulty encountered lies in keeping two gases, which have a natural affinity for each other, apart and distinct. Sometimes they contrive to unite, despite all efforts to separate them.

The different plants which have been constructed from time to time, therefore, pretty much resemble one another, so far as the electrodes are concerned, differing only in minor details. The principal feature of each type of plant, however, is the system of keeping the gases apart after separation, and we will take three or four outstanding types of plants as examples.

In all modern plants where cast-iron electrodes are utilized, it is the practice to have these made of a close-grained cast iron, carefully cleaned and nickel-plated, in order to prevent oxidation.

Perhaps the earliest successful commercial plants employed were those of Garuti, Siemen and Schuckert, whose plants all had one feature in common—namely, a diaphragm of conductive material. A description of the construction of the first-named will, perhaps, suffice as example of the type which, however, differ considerably in detail. The Garuti plant consists of a series of inverted cells built with open ends. These are entirely immersed in the electrolyte. The electrodes are mounted each in its own cell, or gas bell, perhaps, would be the better term, and the whole so arranged that the gas from one set of cells producing hydrogen are led into a collecting chamber, the oxygen being treated similarly.

No doubt the most familiar type of plant at the present time is that which employs a diaphragm of finely-woven asbestos stretched between the electrodes. This material, when immersed in the electrolyte, forms a very efficient gas screen, permitting the electrical current to pass freely from one electrode to another through the solution held in the pores of the asbestos diaphragm. This diaphragm, however, is practically impervious to gas, and, consequently, the gases are not liable to mix. In this type of plant we may classify the Oerlikon and Integral Oxygen Co.'s apparatus.

The Geeraerd System is on differing lines, as it is claimed to dispense altogether with a diaphragm, and to separate the gas by mechanical methods.

Oerlikon Plant

The apparatus manufactured by Messrs. The Oerlikon Co., consists of a series of electrodes, each separated and insulated from its neighbor by a diaphragm of woven asbestos, which is furnished with a specially-prepared rubber border. The electrodes are approximately square, and, as will be seen from the illustration, are furnished with grooves vertically arranged up the plate. A gas channel is provided at each of the upper corners, and these are so arranged that each channel is connected by means of a small passage to one side of the plate.

Referring to the illustration of the complete battery, it is clear that the plates are mounted after the manner of a filter press, the electrodes and diaphragms being placed alternatively. The reason for the rubber border on the diaphragm now becomes clear, as this fitting on the machined face of the electrode provides a water-tight joint.

The whole of the plates are screwed up in the press, the projecting arms on each side resting on insulated tubes through which passes the main stay-bolts. The only path open to the current, therefore, is through the electrolyte and electrode faces. The gas from each side of the electrode is passed into its respective channel, and oxygen and hydrogen channels each form practically one continuous tube.

The large separation pots are in communication with the main channels, and to there the gases pass, becoming separated from the solution, which returns to the cell, maintaining the working level of liquid. It must be noted that the only material used in this and other electrolytic apparatus is pure distilled water, which has to be added from time to time, in order to compensate for the gas generated.

The soda in solution does not require replenishing, save only at very long intervals.

The Integral Oxygen Co.'s Plant

The latest apparatus placed on the market by the Integral Oxygen Co. is a very sound mechanically-arranged plant. One of the good features of this apparatus is that each cell is entirely separate, only being in electrical contact with its neighbor. A reference to the illustration, showing the cell with part of one electrode broken away, gives a very clear idea of its construction. The main casting consists of what might be termed a frame section, in the centre of which is stretched the asbestos diaphragm. The diaphragm is held in position by means of a plate screwed to the main body. Each of the door plates forms an electrode, which is insulated from the main casting, to which it is bolted, by means of a special joint on the face, bushed bolt holes and insulating washers.

The faces of these plates are arranged with small pyramid-shaped projections, which give a very largely-increased electrode surface. The plate forming the anode or positive plate at which the oxygen is liberated, is heavily nickel plated to resist attack by the oxygen gas.

A very ingenious feature is provided in the glass bells at the upper part of the cell, into two of which the hydrogen and oxygen gas, respectively, is led. The gases pass through a swan-necked pipe to below the water level in the glass bells, and thus the gas, bubbling through the water, gives at all times a ready and visible indication of the working of the plant.

The third gas bell is for the purpose of a water-feed indicator, and distilled water is allowed to drip into this at a rate corresponding to the outflow of gas. In event of any mishap taking place, any of the cells may be taken out, without any loss of time, and the battery again put into operation by substituting copper connections in place of the faulty cell.

Geeraerd System

A somewhat novel plant was invented in the year 1916 by Monsieur Geeraerd, a Belgian engineer, and, generally speaking, has opened up a new system of gas production. Hitherto, all the plants which we have reviewed have had some form of diaphragm interposed between the electrodes; but in this plant such diaphragm is entirely done away with, and the gas separated on what is claimed to be an entirely mechanical principle. Each cell consists of a frame-like section, the electrodes being in the centre. Two gas channels, of course, are provided, each of which leads, by means of a duct, to opposite sides of the plate. The interior of the cell is fitted with a large number of glass vanes, which are held in position by ebonite grooved blocks lying at each end within the surface of the outer flange, and retained by a fin projecting on the casting. Both sides of the plate are mounted alike in this respect, and each cell is separated from its neighbor by a rubber joint which projects downwords into the cell for a space of about four inches, at the outer extremity between the faces, acting both as an insulator and a water-tight joint. The cells are in communication with each other at the bottom through a series of holes, which permit a level of electrolyte to be constant throughout the battery. In order to appreciate the principle upon which this plant works, it is necessary to imagine a single cell with the glass vanes in position, and filled with the electrolyte to the top. As current is passed through and decomposition takes place on the face of the electrodes, the gases are liberated in the form of small bubbles, and naturally rise to the top of the cell. One would think that the fact of the hydrogen being liberated on the one side of the cell and the oxygen being liberated on the other side of the same cell that a mixture of the gases would take place. This, however, does caught by a glass vane and is rejected and deflected towards the electrode at which it was formed. The upward movement of the gases to the top of the cell causes a circulatory movement in the electrolyte, which has a tendency to accelerate the passage of the gas up the plate.

A small battery of twenty cells is shown also, complete with the gas separator pots and filling funnel mounted in position, though in practice it is usual to have the gas off-takes in the centre of the battery instead of one end. The purpose fulfilled by the projecting rubber screen at the top of the cell is to prevent the gases mixing.

Installation Points

The modern plant may be taken altogether as a perfectly safe apparatus to instal. No doubt the fact of the dangerous qualities of the gases may, hitherto, have deterred some firms from installing the plant.

There is, however, no more risk in connection with oxygen and hydrogen than with our own domestic supply of town gas. Of course, when people begin to look for a gas leak with a candle, and find it, there is apt to be some little consternation. It is not fair, however, to blame the gas supply for that.

Certain precautions should be taken, at all times, and these are:—

1. The generating station should be well lighted, both by sufficient windows and well-arranged electric lighting for night use.

2. A constant room temperature should be maintained, as this both saves current which has to be utilized in warming up the plant to a working temperature and does away with risk of freezing in winter.

3. Good ventilation should be provided in both generating house, compressing rooms and filling station, and, if possible, separate filling stations for each gas should be provided, unless the filling station is of ample size. On the Continent, certain regulations compel a wall, about six feet high, between compressing and filling stations where, in the latter, motor-driven compressors are used.

4. A log sheet should be provided and kept regularly at stated intervals, whilst the gas analysis should be carefully taken and noted. (The analysis is quite simple, by the way.) The advantage of keeping these records is apparent, as the performance of the plant can be carefully watched, and if the plant shows a high internal resistance, the electrolyte might be strengthened if weak, or cleaned out if necessary.

5. Hydraulic seals should be installed between the plant and gas-holder.

6. It is usually better and safer to have an oxygen purifier inserted between the plant and gas-holder, consisting of a mass of platinized asbestos heated by a platinum spiral connected in shunt with two or three cells of the battery. The current employed to keep this working is very minute, and it is impossible for an igniting mixture of oxygen and hydrogen to pass this and accumulate in the gas-holder. Should there be a small percentage of hydrogen mixed with the oxygen, the purifier will consume the hydrogen, causing a recombination of H_2O in form of water vapor. The oxygen collecting in the gas-holder then, at all times, ought to be about 99.7 per cent. of purity.

Ignition and slow combustion usually take place with about 94 per cent. of oxygen and 6 per cent. of hydrogen, whilst 8 per cent. of hydrogen gives an explosive mixture, though this is no more alarming than a back-fire in an acetylene blow-pipe.

Oxygen Analysis

Different methods are employed for analyzing the gas, but a very simple and ready means is provided by a Hempel's graduated burette, with levelling tube, and a simple absorption pipette, the latter being charged with clippings of copper foil. Into this is poured a solution of one-third strong ammonia, one-third ammonia carbonate liquor (made by dissolving ammonia carbonate in ammonia), and one-third distilled water.

The Hempels burette, graduated to 100 cubic centimetres, and its levelling tube, is first of all filled with distilled water and all air excluded. A supply of the oxygen gas to be tested is filled in to measure 50 cubic centimetres. The air is then excluded from the pipette and the gas siphoned into the pipette.

The free oxygen rapidly combines with the copper in forming oxide of copper, which gives the bluish tinge in the pipette, and an occasional shaking expedites the process in removing the oxide from the surface of the copper. When the absorption is complete, the remaining gas is siphoned back to the burette and the figure read off. As this is the result of 50 cubic centimetres, it follows that the reading must be multiplied by two in order to give the correct percentage of impurity.

Diagram of Layout of Plant

This diagram is applicable to any electrolytic installation, and should be quite clear. The electrical connections to the plant are shown, together with the pipe lines leading to gas-holders, and from there to the filling stations.

In cases where filling stations are not required, the gases pass through low pressure compressors and receivers. Piping from there leads on to the welding benches, where provision is made for the oxygen regulators as usual.

Application

Whatever type of plant may be employed, it must be understood that the chief point in our discussion lies in the application of the oxygen gas to our particular industry. It is, of course, impossible to give cost prices of the various plants, but perhaps our illustration may serve as a method of arriving at the cost of oxygen production. In dealing with these figures, it is difficult to give anything like the actual estimate of gas cost, for the simple reason that the cost of electrical energy varies in almost every district, and also, in many cases, in accordance with demand. A works situated in a small town may have to pay as much as 2d. per B.O.T. unit, whilst another concern, which employs blast furnaces and utilizes the waste gas in generating its own power, produces electrical energy at a figure which is almost negligible. In either case, an important factor ruling the question of a works installing its own oxygen plant, is the carriage and handling charges which have to be paid on the full and empty cylinders. The author, in his investigations, has frequently found that these are not always included in the estimate of the cost of gas; but is only right that they should be.

The examples of quotation which we give as illustration will, perhaps, show the number of ways in which the subject might be treated, according to the circumstances under which the gas is to be produced and used.

The first case we will take is the works which is using a quantity of 5,000 cubic feet of oxygen per week, but which gas can only be produced during the hours of work, say 50 hours. In the second case, we will take the cost of production when it is possible to run the plant 24 hours per day for five days per week. The first proposition requires nearly double the capital outlay of the second as, naturally, the generating plant has to be of larger capacity, though in the second case the storage capacity has to be greater. The interesting part lies in the comparative return on capital outlay.

It must, of course, be clearly understood that these figures are only representative and do not apply to any particular plant.

Another question governing the capital outlay is the point as to whether the gas has to be compressed into cylinders or led through piping to the welding benches. In this first case, it will be necessary to have high pressure compressors, whilst in the second case, a low pressure compressor, working up to perhaps 100 lbs. per square inch, with a suitable receiver sufficiently large to maintain a few hours' supply with all plant shut down, will be ample.

In some works, both hydrogen and oxygen gas are utilized; in others, one of the gases is allowed to waste, with the result that, whilst capital laid out in gas-holders, compressing plant, etc., is smaller, the whole of the cost of operation and current has to be charged up to the remaining gas used.

It is essential that each plant be fitted to its own particular requirements, and the cost based accordingly, as in no two cases has the author found exactly similar circumstances to be overcome.

Following are costs as given in Mr. Stanfield's paper. These are left in their original state, not being converted into dollars and cents, simply because conditions over here are somewhat different from that in the British Isles.

Case I

The first case we have taken is the works using 5,000 cubic feet of oxygen per week of 50 hours, and generating gas on a ten-hour day basis.

Supposing that both oxygen and hydrogen were to be compressed into cylinders, the capital outlay would be, approximately:—

Electrolytic plant, including switchboard, gas separators, purifiers and hydraulic seals	£1,350 0 0
Hydrogen gasholder, 1,000 c. ft. capacity	260 0 0
Oxygen gasholder, 600 c. ft. capacity	130 0 0
High pressure hydrogen compressor	180 0 0
High pressure oxygen compressor	150 0 0
	£2,070 0 0

The production cost sheet is practically self-explanatory.

Production Cost on Hydrogen and Oxygen

For output of 5,000 cubic feet of Oxygen per week (10-hour day generation basis):

	Per hour c. ft.	Per day 10 hours c. ft.	Per year 300 days c. ft.
Oxygen	100	1,000	300,000
Hydrogen	200	2,000	600,000

Electrical energy required to produce one thousand cubic feet of Oxygen and two thousand cubic feet of Hydrogen—312 B.O.T units.

Cost of Energy at 1d per unit—

Per 1,000 c. ft. Oxygen	13/-
Per 1,000 c. ft. Hydrogen	6/6

Overhead Cost

5% interest on £2,070 capital outlay	£103 10 0
10% depreciation	207 0 0
Attendance—Day, one man 4 hours × 300 days at 1/-	60 0 0
Sundries (oil, waste, etc.), say	10 0 0

Net overhead cost of—300 thousand c. ft. Oxygen, 600 thousand c. ft. hydrogen. £380 10 0

Total cost per thousand c. ft.—

Oxygen,	12/8 plus 13/- for current	26/8
Hydrogen,	6/4 plus 6/6 for current	12/10

Now again supposing that this works was in the habit of buying this quantity of gas per annum, the saving would be considerable.

Cost of 300,000 c. ft. of Oxygen at £2 per thousand	£600
Cost of 600,000 c. ft. of Hydrogen at £1 15s 0d per thousand	1,050
Carriage on 900 cylinders at 1/- each	45
	£1,695

In all likelihood the cylinders would have to be purchased, for which additional capital would be required:

50 Oxygen cylinders, 100 Hydrogen cylinders, at say £5 each	£750
Interest and depreciation on £760 at 20 per cent.	£150 0 0
Cost of producing gases	380 10 0
Cost of current	390 0 0
	£920 10 0
Total cost of purchasing gases	£1,695 0 0
Total cost of production	920 10 0
Saving per annum	£774 10 0
Total capital outlay	£2,070
	760
	£2,820

£774 10s return on £2,820 is equivalent to about 27 per cent. profit.

Case II

Works using 5,000 cubic feet of Oxygen during a working week of 50 hours and generating gas on a 24-hour day basis.

As a smaller generating plant will now be required, actually less than half the size, the figures will be approximately:

Electrolytic plant, switchboard, etc., as before	£600
Hydrogen gasholder of 2,000 c. ft. capacity	400
Oxygen gasholder of 1,000 c. ft. capacity	260
Compressors, as before	330
	£1,590
Cylinders, as before	£760

Production Cost on Hydrogen and Oxygen

For output of 5,000 cubic feet of Oxygen per week (24-hour day generating basis):

	Per hour c. ft.	Per day 24 hours c. ft.	Per year 300 days c. ft.
Oxygen (approx.)	42	1,000	300,000
Hydrogen	84	2,000	600,000

Electrical energy required to produce one thousand cubic feet of Oxygen and two thousand cubic feet of Hydrogen = 312 B.O.T. units.

Cost of Energy at 1d per unit—

Per 1,000 c. ft. Oxygen	13/-
Per 1,000 c. ft. Hydrogen	6/6

Overhead Cost

5% interest on £1,590 capital outlay	£79 10 0
10% depreciation	159 0 0
Attendance—Day, one man 4 hours × 300 days at 1/-; Night, one man 4 hours × 300 nights at 1/-	120 0 0
Sundries (oil, waste, etc.), say	20 0 0
	£378 10 0

Total cost per 1,000 c. ft.—

Oxygen,	12/6 plus 13/- for current	25/6
Hydrogen,	6/3 plus 6/6 for current	12/9

Cost of purchasing gas and carriage Case 1		£1,695 0 0
Interest and depreciation on cylinders as before	£160 0 0	
Cost of producing gases	378 10 0	
Cost of current	390 0 0	
		918 10 0
		£776 10 0
Total plant outlay		£1,590
Cylinders		760
		£2,340

£776 10s return on £2,340 is equivalent to about 33 1/3 per cent.

There is practically no difference in the cost per 1,000 cubic feet of oxygen in Case I and Case II; but where a large installation and a larger capital is concerned, the portion allowed for attendances and sundries is smaller in proportion to the interest and depreciation cost allowed, thus a difference in the cost of some shillings per 1,000 cubic feet may be shown.

The foregoing examples are probably open to a great deal of criticism, and rightly too. For example, one firm may use both oxygen and hydrogen, another uses oxygen alone.

In one case, a firm may pay 1½d. or 2d. per B.O.T. unit for current; in the next case, the charge for current is nil. On the other hand, the author has known oxygen to cost 75s. per 1,000 cubic feet, including carriage charges, and 65s. is by no means an out-of-the-way figure.

Some firms may have to lay down a special motor generator-set to produce the necessary current; others can run direct off the main switchboard. In probably 100 cases investigated, no two sets of conditions were alike.

The problem to be solved is, therefore, "would it pay you to instal an oxygen-producing plant for your own use?"

The matter can easily be settled by applying to some of the firms who are supplying the apparatus, and who would give full information on the subject.

To quote a parallel case, we all realize the use and advantage of having dissolved acetylene supplied in cylinders, and without such a facility we should be badly handicapped very often indeed. At the present day, no firm would dream of laying out a welding shop to employ a number of welders and arrange to instal and work off dissolved acetylene cylinders. The cost would be too great. In the same way, the works of the future, as well as many of the present day factories, will instal their own oxygen plants as naturally as now they instal an acetylene plant.

Some years ago the author was engaged in pioneer work in connection with acetylene welding, arranging lectures and demonstrations all over the country. These created a great deal of interest, but even large firms were very dubious about installing oxy-acetylene welding. That time is now past, and many of these particular firms are among our largest users of acetylene gas, doing work which previously was classified as unsuitable. Particularly during the war, new applications and processes were found almost daily in the manufacture of articles which, prior to the war, were not even considered as likely objects for welding. Just now we are in the comparatively early stages, and perhaps no great time will elapse until the oxy-acetylene process will be awarded its own place as one of the most valuable assets in modern engineering practice.

FINISH THE JOB

How you start is important, very important, but in the end it is how you finish that counts.

The victor in the race is not the one who dashes off swiftest, but the one who leads at the finish.

In the race for success, speed is less than stamina.

Columbus finished his job. So did Washington. So did Lincoln.

Look around to-day.

H. C. Frick, whose recently-published will constitutes one of the noblest documents of America's annals, won because he refused to quit when, engulfed by the panic of '73, his associates and others engaged in the infant coke industry showed the white feather and gave up.

Andrew Carnegie earned most of his fortune by boldly buying out discouraged partners who lost their nerve and their sticktoitiveness.

John D. Rockefeller held on grimly and resolutely when others lost their faith in so mercurial and uncertain a commodity as oil, with its frequent disasters from fire.

Finishing the job isn't always easy. Very often the easiest thing would be to quit. We all are tempted to succumb to difficulties, discouragements, failures, hardships, disasters. We all have moments when we feel, "What's the use?"

But if we are made of firm stuff, if we have the backbone of a man and not a jelly-fish, if we have confidence in ourselves and faith in God, if we know that we are giving our lives a clean, worthy, healthy, helpful purpose, then we pull our belts a notch tighter, we grit our teeth a little harder, we face east, eyes front, and with unfaltering step push forward determined to halt not and whimper not until we finally gain our goal.—Forbes Magazine.

Chart of the Torsional Strength of Shafts

By the Use of the Accompanying Chart the Figuring of the Strength of Shafts is Made Comparatively Easy. Much Time Can be Saved Over the Laborious Use of Mathematics

By JOHN S. WATTS

THE accompanying chart will be found useful in determining the diameter of a shaft required to carry a given torque or torsional moment at any stress from 4,500 to 12,000 pounds per square inch.

To use the chart, simply follow along the horizontal line for the required torque and read off the diameter of the shaft on the diagonal line that intersects this horizontal line at the vertical line for the stress decided upon.

For example, the diameter of shaft required to carry a torsional moment of 120,000 inch pounds at a stress of 6,500 pounds per square inch, will be 4 9-16 in.

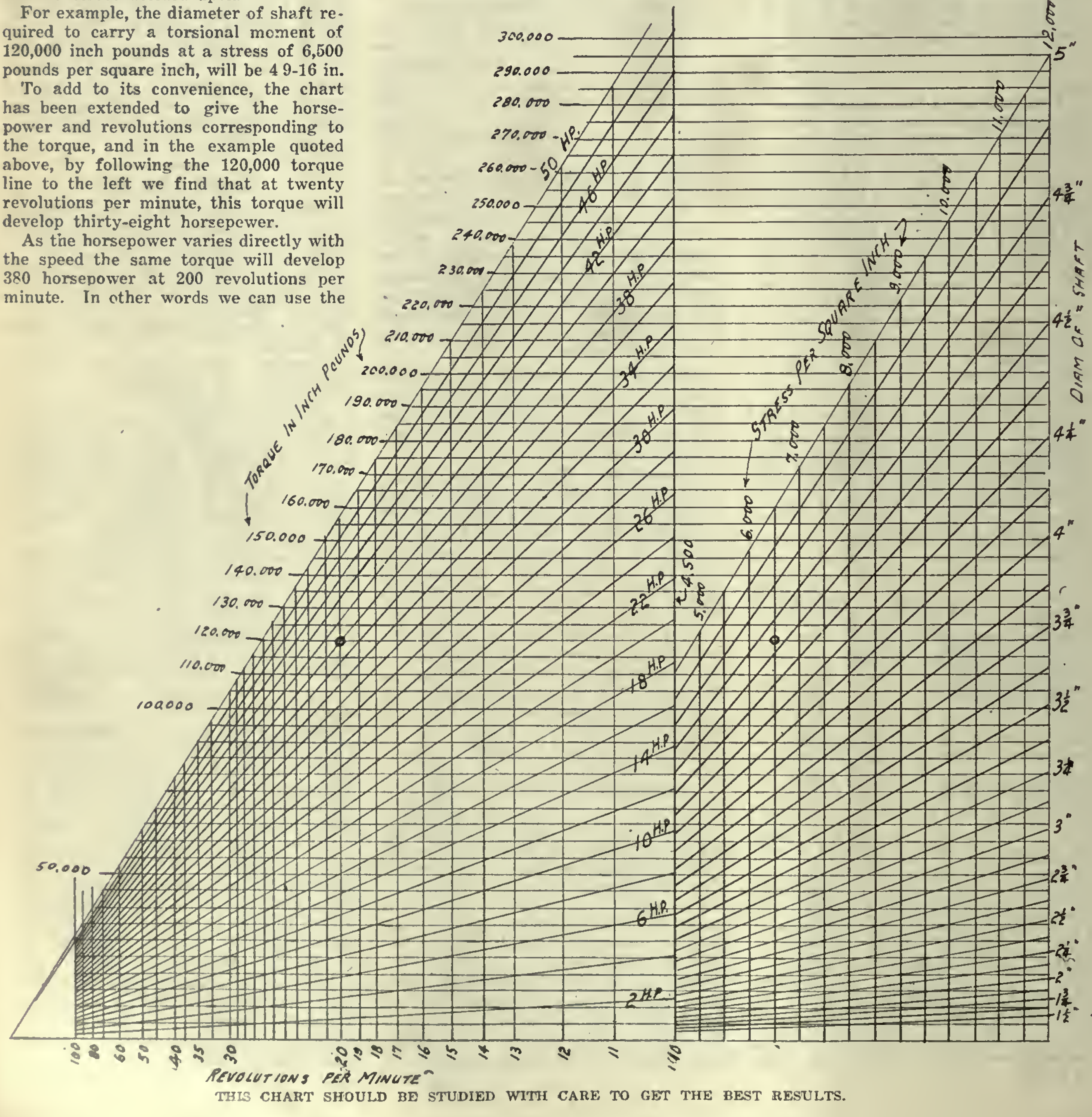
To add to its convenience, the chart has been extended to give the horsepower and revolutions corresponding to the torque, and in the example quoted above, by following the 120,000 torque line to the left we find that at twenty revolutions per minute, this torque will develop thirty-eight horsepewer.

As the horsepower varies directly with the speed the same torque will develop 380 horsepower at 200 revolutions per minute. In other words we can use the chart for horsepowers and speeds above or below its range by simply dividing or multiplying the horsepower and the speed by ten, or any other convenient figure.

This enables us to use the chart to determine the size of shaft (up to 5 in. diameter) required to transmit any horsepower at any revolutions per minute, when the horsepower is given instead of the torque.

The chart will also be of material assistance in calculating geared or belt-drives, to transmit a given horsepower at a given speed as from the intersection of the horsepower and revolutions lines we read the corresponding torque, which, being divided by the radius in inches of the gear or pulley, will give us the load in pounds, to be transmitted by the teeth of the gear or by the belt.

It should be remembered that if the



THIS CHART SHOULD BE STUDIED WITH CARE TO GET THE BEST RESULTS.

gears or pulleys on the shaft are not close up to the bearings, a bending stress will be added to the torsional stress, and the shaft must be increased in diameter to take care of this additional stress.

The lowest stress, 4,500 pounds, should be used when the load is constantly reversing in direction and is suddenly applied.

A stress of 9,000 pounds may be used when the load is gradually applied, without shock and gradually reversed.

The maximum stress of 12,000 pounds is allowable only when the load is steady, does not reverse, and is applied gradually without shock.

A description of the method used in constructing this chart may be of interest and a help in making up other charts for solving similar problems.

First, we lay off the horizontal lines for the torques to a convenient scale, in this case 1 in. equals 40,000 inch pounds, and calculate the torsional strength of each diameter of shaft at the maximum stress, 12,000 pounds per square inch, by the formulae

$$T = \frac{\pi}{16} fd^3$$

and mark points on the torque scale to indicate each diameter at the points corresponding to the strength so calculated.

Now the maximum stress being 12,000 pounds per square inch, we measure along the base line, to the left, a distance equal to 12,000 to any scale, in our case we have chosen ⅜ in. = 1,000, and draw the diagonal lines for each diameter to this point.

Measuring back from this same point, distances equal to 4,500, 5,000, 5,500, etc., etc., and erecting vertical lines at each point, it is obvious that the height of each of these vertical lines to its intersection with any diameter diagonal line will be equal to the torsional strength of that diameter of shaft at that stress for which the vertical line is marked.

Now, coming to the triangle at the left, we calculate the torque which will be developed at ten revolutions per minute by fifty horsepower, by the following formulae:

Let T = torque in inch pounds.

$$\text{Then h.p.} = \frac{T \times \frac{2\pi}{12} \times \text{r.p.m.}}{33{,}000}$$

$$\therefore T = \frac{\text{h.p.} \times 33{,}000}{\frac{2\pi}{12} \times \text{r.p.m.}}$$

Marking this point on the torque scale on the central vertical line we have the point corresponding to 50 horsepower, and by dividing this height into twenty-five parts we get point for the torque corresponding to each increment of 2 horsepower up to 50 horsepower at ten revolutions per minute.

We now make the base line of the left-hand triangle ten inches long (to a scale of half size in the chart) because ten is the number of revolutions we assumed for the calculation of the horsepower on the central vertical line.

Now, as the torque is proportional to the $\frac{\text{h.p.}}{\text{r.p.m.}}$, we scale back to the right from the end of the base line, distances equal to $\frac{10}{100}$, $\frac{10}{90}$, $\frac{10}{80}$, $\frac{10}{70}$, etc., the denominator of these fractions being the revolutions per minute in each case, and raise vertical lines at each point so marked.

It can be seen that the height of any of these vertical lines to its intersection with any horsepower diagonal line will be proportional to the torque delivered by that horsepower at that number of revolutions.

MANGANESE STEEL

The welding of manganese steel is a problem which is usually found in the frog shop on railroads, although dredge dippers, safes, and other machine parts are manufactured from this metal. Some authorities claim that it is possible to weld manganese steel successfully, but in the author's opinion the process is not yet a complete success, by the oxy-acetylene process.

Manganese frogs and crossings contain between 11 per cent. and 13 per cent. manganese, and the nature of the problem will be better understood when it is explained that when the manganese content is increased above 2 or 3 per cent. the strength and ductility decreases, while the hardness increases.

Manganese frogs and crossings frequently require building up at low points. These low spots are usually caused by the metal becoming fatigued and sagging from the constant pounding of rolling equipment. When made, frogs or crossings occasionally contain blow holes, or pockets, not visible to the eye. These pockets are generally just below the low point and extend the full length of the section which requires building up. Frogs and crossings containing such defects are not susceptible to a welding process. Should the section require the building up of a worn spot caused only by constant pounding, it may be treated autogenously.

The frog or crossing should be preheated to about 1,250 deg. Fahr. (medium cherry), and after the worn spots are built up, during which process the frog or crossing is kept at the aforementioned temperature, it is allowed to cool very slowly. This can be accomplished by burying the object in dry sand.

The parts to be built up should, prior to starting the building up operation, be thoroughly cleaned. Either files, wire brushes, or a portable grinder may be used for this purpose.

The low sections should be built up in sections of about 1 square inch each. Care should be taken to raise the built-up section to the proper height. While the metal of each section is still hot the section should be hammered. This not only expands the new metal but also serves to impart a finished appearance to the weld. The proper surface alignment may be maintained by the use of a straight edge.

Another method which has been used with success is to immerse the frog or crossing in a pan of sufficient depth and width to permit surrounding the entire object with water, a space of but about ¾ of an inch below the surface of the rail showing. This pan may be so constructed that a constant flow of cold water passes through it. When this method is used no after treatment is necessary.

The correct filler rod to use for this work is manganese, and these rods may be made by cutting up old manganese rails. Manganese welding rods are now manufactured for the welding trade. As manganese possesses a marked affinity for oxygen, however, and will burn out very rapidly under the influence of the torch, the necessary rods should not be cut out from old rails with cutting torch. Some other method should be used, or preferably, new rods procured. The process of building up the worn section will in itself burn out manganese from both the original rail section to as near a 11-13 per cent. content as possible, it is advisable not to multiply the difficulties by an advance reduction of the manganese content in the filler rod.

The author has heard welders complain that under the action of the torch manganese steel would "foam," making it exceedingly difficult to execute welds. As a proposed remedy for this difficulty it has been proposed that a very fine aluminum wire be wound around the manganese welding rod in the form of long spirals. The introduction of a very small quantity of aluminum into the weld is said to "quiet" the metal. So-called foaming, however, is an indication that the manganese content has been reduced to a very small percentage.—"Welding Engineer."

An important improvement in the manufacture of coal gas has been perfected by the engineers of a gas company in London, Eng. They have contrived to extract from the gas all the carbon bisulphide—a substance which, when burned, had a deleterious effect on health and also on various materials. Throughout most of the nineteenth century, chemists and engineers strove to solve this problem, but success did not come till the year 1914. The war prevented the erection of plant to carry out the process, but the way is now open for the general adoption of a method which will make a gas flame as harmless to its surroundings as a candle. The process is a catalytic one, the extraction of the impurity being effected by a substance which remains unchanged in spite of its activity. It may be added that British gas companies are now adopting the scientific principle of charging for gas on the basis, not of mere quantity, but of heat-value.

WHAT OUR READERS THINK AND DO

Some Drafting Course Remarks

[Contributed by the Students]

HERE are a few excerpts from replies received relative to our drawing course. The first to speak is a Hamiltonian:

"It gives me pleasure to write my opinions regarding your drawing course. First of all let me state frankly that I was one of those that started to send in my plates. I failed to keep it up on account of my health. I am a returned soldier and have suffered from time to time with my disability. It is this fact that has meant my failure to send the plates in promptly.

"I have been in the hospital several times, so you can see why I failed to send my work along, but I never failed to cut the drafting course out of the magazine in order that I could follow it up. I should be very sorry to see you put an end to the course, for I assure you the lessons are a great benefit to all. Personally I took up a course in tool making under the Soldiers' Re-establishment, but that was not enough. I can honestly state that I have got as much good from your drafting course as I got from my other study.

"I may be one out of a great many that do your plates as they get a chance, so I sincerely hope you will see fit to continue the course.

"Very truly yours,
"H. CRABTREE."

This One From Brandon, Manitoba

"Your personal chat with your drawing students was no doubt read with interest by not only your active students but by these who are plodding along quietly. This class I honestly believe constitutes a large number of your following. They look forward from week to week for your course, and as they follow the same closely, they feel, or should feel that they are slowly but surely laying down a foundation well worth while. In a quiet way I am assimilating your drafting lessons. I have never sent in any plates, nevertheless my interest in your course is keen, and I keep every copy so that I can go back to it for reference any time I desire.

"I would like to answer briefly your questions as follows: Relative to why you are not receiving more plates, I would say that when your course started I was fully determined to send in my work from week to week and purchased all supplies as instructed. I had some difficulty in procuring these as they could not be obtained locally, and besides working from 7 a.m. to 10 p.m. does not leave one in the best condition to compete successfully in a drafting competition, so I decided to plod along quietly and do my best alone.

"I realize that some of these reasons leave me open to well-merited censure, but this is the true reason and may be the cause of a great falling off in the number of plates received.

"You also ask, 'Are the plates too difficult, etc.?' In answer to this I would say to all the questions, 'No.' One outstanding feature of your course is simplicity of speech and clarity of your subject. One has very little trouble in getting a sure grip of each lesson. Speaking for myself I would say that you are not travelling too fast. Your course is so arranged that one is always anticipating what is coming next, so this answers your question: 'Is interest ceasing?' Once more I would repeat, 'no.'

"I am very pleased to have this opportunity of thanking you for the spirit of helpfulness which is an outstanding feature of the course, and hoping you will continue the good work.

"I am, yours truly,
"JNO. S. MILLER."

Up Speaks a Kitchenerite

"I have noted the personal chat addressed to drawing students and the cap would not have fitted better had it been entitled 'Individual Personal Chat.'

"I am very much interested in your course, and have profited very much by it already. I have failed to send in the last two drawings because of lack of time, not lack of interest. The lessons are prepared in the simplest of language, and the ordinary mechanic who is trying to take advantage of the opportunity ought to have no difficulty. I have derived a great amount of information already. I am working on a mechanical contrivance and wrote to a well-known firm in Toronto for information on the application of some of their products to my needs. I drew a sketch noting changes desired, and they understood my wants readily, and were able to give me all desired information without correspondence.

"The course is not progressing too rapidly for me, and is not lacking in interest. As soon as I get my copy of CANADIAN MACHINERY I look the drafting course up first. If a person is going to make the most of these lessons I believe he should start right in to study the week he receives the copy and not settle down to work a week later. He will find something perhaps a little harder than he expected and be late in sending in his plate. Once he is late a few times he is on the fair road to losing interest.

"In closing I hope I have answered the questions satisfactorily, and promise to be more faithful in my work in the future.

"Yours truly,
G. ARUNDEL LAMB."

Here are two more short reasons why we should keep on with the course:

"Although we have drawing classes at the shop where I work, I wait with interest the lessons in your paper. I know I am not the only one that does so. I have not sent in any plates as yet but expect to before long. Perhaps the reason the drawings are not coming in so quickly is because of the sickness going around.

"I find only one fault with the course, and that is they do not appear often enough. I think every week would be best, as two weeks is too long to wait. With hopes that they will be continued,

"Yours truly,
"G. R. HARTLEY.
"Coteau Station, Que."

This One is From Toronto

"The reason I have not been sending in my plates is because I've been studying them at home and also attending night school. Now that school is about over I will start in once more to send my plates.

"Regarding the course itself I have no fault to find. The plates are not too difficult or intricate, and the instructions are always sufficiently clear.

"In closing I might say that the course is the most interesting and helpful series of studies that has ever been published in your journal.

" H. SCOTT."

Our Answer

We appreciate the many replies sent in but which are impossible to reprint owing to their number, so we will content ourselves with assuring students of the continuance of the course commencing April 8th issue.

We would suggest that Mr. Lamb's idea be carried out. The moment you receive your copy get busy; prepare your work and send it in. Should you desire to prepare the work at home, do so, but write in telling us you are working on the course. We desire to ascertain how many readers are actually following the lessons. This is not much to ask of each student. Merely drop us a line saying you are following the course. By this means we will know the interest is sufficient to warrant the work entailed in its preparation. Please remember this and if you decide to follow the lessons write us as soon as you receive your April 8 issue.

CONVERTING A BREAST DRILL INTO A DRILL PRESS

By W. S. Standiford

One of the most useful devices that every mechanic or experimenter has in his home workshop is a breast drill. The drawbacks of this instrument are that it has to be held very carefully if a straight hole is to be bored; and also that it requires considerable "brute force" to make the drill feed into the work. After using a breast drill in the usual manner for a number of years, the writer decided to convert it into a drill press, and thus make it not only easier to operate, but also to do more accurate work than a drill pressed against the body is capable of.

The photographs show the general construction clearly, no dimensions being necessary, as each breast drill made varies so in size that the construction will have to be made to suit the users' instrument; the only thing to do is to follow the shape as depicted in the photographs. Fig. 1 shows the completed apparatus ready for a drill to be inserted. It will be seen that the feed is automatic, it being done by gravity when using a 1-16 inch drill, but wide rubber bands are used to assist the weight of the drill rack and round bar iron weight when larger sizes are used. The bands are put on the projecting lower ends of drill rack (only side being shown in the photograph) and a round pin on the sides of the standards. As this press has been in use for a number of years, using rubber bands, the writer intends to replace them with closed-coil springs fixed to a hinge on their lower ends, so as to be disconnected when the press is used for boring small holes, as too speedy drilling dulls the drills quickly. Closed-coil springs are better than the rubber bands when working with larger drills, as more pressure can be obtained, the amount depending upon the diameter of the wire thickness in the springs.

Fig. 2 shows the standards with the drill rack out, while Fig. 3 illustrates the rack itself, the round bar iron weight being removed from its retaining prongs. The upright wooden standards should be made out of hardwood and have the slots that drill rack slides in carefully made and fitted to the former, so as to have just enough play to let it slide freely up and down. Rub dry graphite on the bearing parts of standards every once in a while, so as to get the wood saturated as much as possible. Use a square when fastening standards on the baseboard. Put cleats upon the cross bars of drill rack, so as to prevent any side play, thus insuring that the holes bored will be straight. This apparatus will be found to give good service in the home workshop, mine being in use over ten years. It is still in good condition, with the exception of the rubber bands, which occasionally get hard and lose their elasticity; the latter being restored by soaking them in kerosene oil. I would advise any other constructor to use closed-coil springs, as it is a nuisance to be fooling with rubber bands. Closed-coil springs will give no trouble.

Legions of inventions have been made to prevent the skidding of rubber tyres, but no one device can be said to be completely satisfactory, either in obviating side-slip or in avoiding damage to the roadway and to the tyre itself. Chains, studs, and all sorts of rubber protuberances have been tried without real success. A British engineer has, however, been working along much simpler and more scientific lines, with most promising results. His notion is to shape the tyre so that when it is in contact with the road it lies flat with a definite edge on each side. Any tendency to skid is resisted by the "squeegee" action of the tyre in this position. Trials have shown that incipient side-slips are quickly checked and that the tyre wears well and has no bad effect on road surfaces.

An original type of heavy motor truck has been produced by a British firm. It is a six-wheeled tractor-truck capable of carrying a useful load of 7½ tons without exceeding a total weight of 6 tons on any axle. It is also designed to haul a 6-ton trailer and is therefore claimed to give a greater carrying capacity than any other type yet produced, although its weight is practically the same as that of a well-built 3-ton truck. The body portion rests on a turn-table over the middle wheels and ingenious arrangements are made for braking the back wheels. A four-cylinder engine develops 47 horse-power at 1,000 revolutions per minute and drives the vehicle at 12 miles per hour.

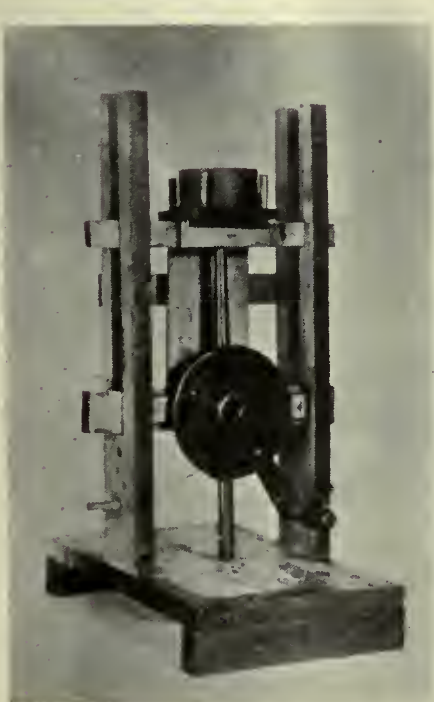
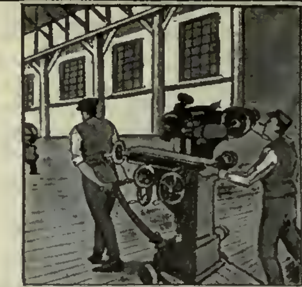


Fig. 1

Fig. 2

Fig. 3

DEVELOPMENTS IN SHOP EQUIPMENT



HIGH POWER MILLER

The first machine to be marketed by the new Ryerson-Conradson Company is that of their No. 3 helical drive high-power miller. This machine is claimed to include new features which will place it among the leaders in the machine-tool field.

The most striking feature in the design of this machine lies in the application of the helical drive. Helical drive gearing is not universally employed in milling machines, due to the inability (up to the invention of the type described) to secure a sufficient range of speeds as required of a commercial milling machine.

The column is an exceptionally rigid casting, thoroughly ribbed internally and cast integral with the base. Surrounding the base is a deep flange which materially stiffens it and serves as an oil retainer. The face of the column is extended above the overarm, affording very firm support for special fixtures.

The knee is heavy and deep, absorbing all vibration due to heavy cuts. The bearing surface between the knee and the column is greatly increased by extending the back of the knee up to a point nearly level with the top of table. The elevating screw telescopes and is located in the centre of gravity to avoid all binding action when raising or lowering.

The table and saddle is provided with large bearing surfaces and the table is provided with three T-slots ⅝ in. wide, and a large groove to retain and lead all cutting compounds to the drain.

The spindle is of .60 carbon steel, accurately ground, running in bearings of phosphor bronze, scraped to fit. The front bearing is tapered and both bearings are adjustable for wear. The faceplate is forged with integral spindle and arranged with two large keys for driving face mills and arbors.

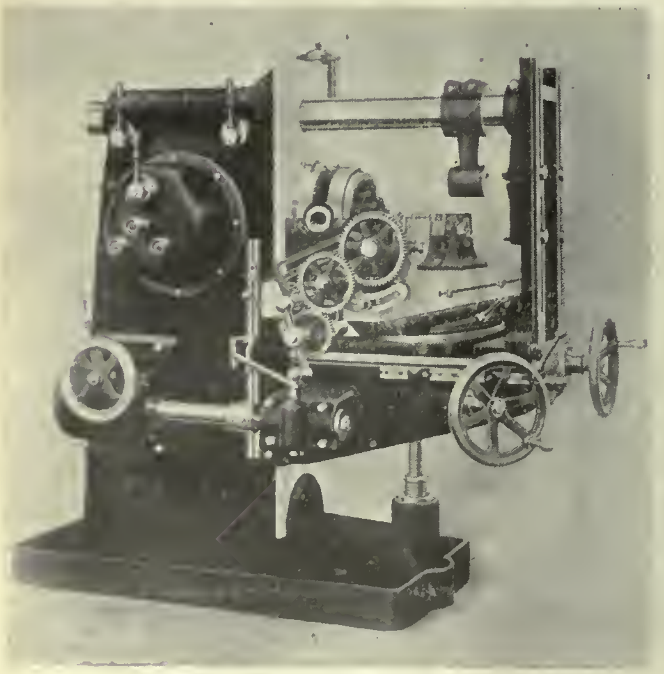
The primary shaft is driven by means of a constant speed pulley on one end and three change gears on the other, which drive a hollow shaft concentric with the primary shaft. This hollow shaft is also provided with two additional change gears, and, in turn, drives either the high speed or low speed set of helical gears which effect the spindle drive. By this method twelve spindle speeds are obtained. ranging from 17 to 290 r.p.m., in practically geometrical progression.

The driving pulley is of the conical friction clutch type and means are provided to automatically apply a brake to the shaft the instant the clutch is disengaged.

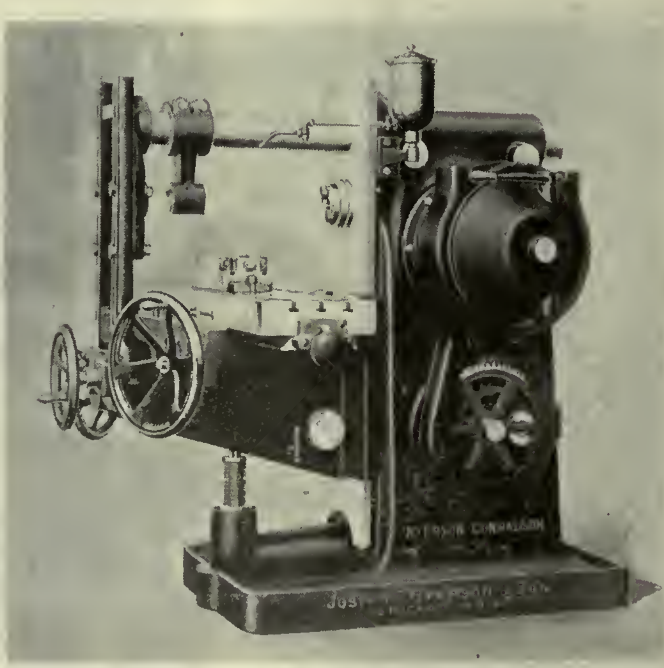
The feed drive is positive from the primary shaft by means of a chain and sprocket. Eight changes are provided by the usual cone of gears in connection with a dive key controlled by a hand wheel, on the circumference of which the various rates of feed are indicated. Two sets of gears, operated by a hand lever, double up the eight feeds, and by this method sixteen feed changes are obtained, ranging from .6 in. to 22.3 in. per minute.

Each feed screw is provided with a graduated dial reading to the thousandths of an inch and readily set back to zero. All feeds are equipped with fixed trips and one adjustable trip which can be placed to stop the table at any desired position along its travel.

These machines are driven at a constant pulley speed of 600 r.p.m., requiring from 5 to 7½ h.p. to operate. The gears run immersed in oil and are completely enclosed, making them dust-proof, and owing to the flooded lubrication are practically noiseless. As the driving pulley is also enclosed the machine conforms to all safety regulations of the Workmen's Compensation laws. All thrust is taken up by S. K. F. ball-bearings. All bearings are bronze bush-



FRONT VIEW OF THE MACHINE.



AS IT APPEARS FROM THE REAR.

ed. Change gears are all cut from solid chrome nickel steel stock and are heat-treated; all others are of steel or bronze, no cast gears being used, with the exception of the large elevating bevel gear, which is of cast steel.

Following are the machine's principal specifications:

HIGH POWER MILLER

Type of Machine.	Plain	Universal
Longitudinal movement	35"	34"
Cross traverse movement	14⅝"	13"
Vertical movement	20"	18½"
Diameter of spindle nose	5 1-16"	5 1-16"
Spindle, front bearing, large end	4¼"	4¼"
Spindle, front bearing, small end	3¾"	3¾"
Spindle, rear bearing	3⅛"	3⅛"
Taper hole in spindle	No. 11 B. & S.	No. 11 B. & S.
Hole through spindle	13-16"	13-16"
Distance, spindle centre to bottom of arm	6 5-16"	6 5-16"
Diatance, end of spindle to arbor bushing	27"	27"
Distance, face of spindle to arm braces	30⅜"	30⅜"
Diameter of overarm	4⅜"	4⅜"
Table dimensiona	63¼" x 12¾"	63¼" to 12¾"
Table working surface	53" x 12¾"	53" x 12¾"
Spindle speeds, range	17 to 290 R.P.M.	17 to 290 R.P.M.
Spindle speeds, number of changes	12	12
Feed range per minute	6" to 22.3"	6" to 22.8"
Feed, number of changes	16	16
Floor Space—		
Parallel to spindle	76½"	76½"
At right angles to apindle	111"	111"
Pulley speed	600 R.P.M.	600 R.P.M.
Pulley diameter	14"	14"
Width of belt	4"	4"
Horse-power required	5 to 7½	5 to 7½
Weight, net	5,575 lbs.	5,910 lbs.

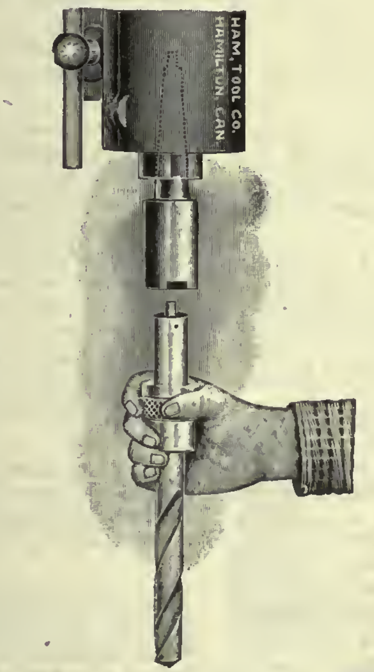
BEAVER CHUCK AND COLLET

The Hamilton Tool Co., Ltd., Hamilton, Canada, have placed on the market what is known as the Beaver clutch and collet. This tool is patented and is especially designed to be used in the rapid interchange of drills, reamers, counterbores, etc., on any machine without stopping the machine. Of course the device is especially useful for drill press work.

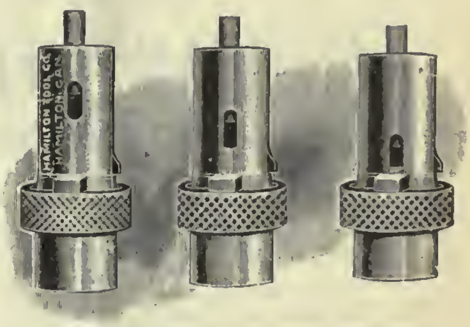
These chucks and collets are made of high grade tool steel and are very simple in construction, positive in operation, and have proven great time savers. A self-contained device releases the collet and tool instantly, requiring neither hammer, wrench, nor key to operate. And it only requires one hand to do it. There is nothing to catch the operator.

Chuck is fitted with a Morse taper shank of the required taper to fit the machine spindle, and is bored so that each collet of the set will fit snugly into it. The collets are bored to take tools having either Morse taper or straight shanks, as required.

Lengthwise of the collet shank is set in a narrow strip of steel which is kept in position by means of a pin and spring. On this steel strip is a catch, which, when the collet is engaged, fits into a groove on the inner side of the chuck, thus holding the collet and tool firmly in position. The inner side of the knurled ring is so constructed that when grasped between the forefinger and the thumb and pulled outward the catch is instantly released, thus freeing the collet and tool from the chuck, which still remains firm in the machine spindle. A spring steel wire firmly seated in a groove around the collet prevents the knurled ring from coming off when being pulled outward to release the collet. The sliding pin in the end of the collet is a very simple and most effective method of knocking out tools.



SHOWING HOW EASY IT IS TO OPERATE.



SOME OTHER VIEWS OF THE COLLETS.

To engage the collet grasp it by the knurled collar and push into the chuck. To disengage the collet, grasp it by the knurled collar and pull straight out from the chuck. The various illustrations explain fully the design of the chuck and its uses.

GENERAL VIEW OF COLLET FOR NO. 1 CHUCK. NOTE THE EJECTING PIN AT THE TOP.

The Halcomb Steel Company of Syracuse, N.Y., publishes prominently in its plant organ, under the heading of "Who's Who in Safety," each month, the names of all foremen in whose departments there were no accidents during the previous month. Directly opposite, under the heading "Those Who Spilled the Beans," are published the names of the other foremen, with the number of accidents charged to his department after each name. The Corn Products Refining Company, Chicago, last October conducted a safety drive among all its plants, at the close of which a bulletin was posted, showing the name of every foreman in whose department one or more accidents had occurred, together with the number of accidents in each department.

Discussing the effect of such publicity, Grover Kingsley, safety engineer of the Halcomb Steel Company, writes: "This has proven a stimulus to good safety work in a great number of instances. Foremen want to keep their names out of the 'Who Spilled the Beans' Column. Contrary to expectations, this sort of publicity does not create antagonism to safety, and I attribute this principally to the humorous phrase used to designate foremen whose departments show accidents."

The Greenfield Tap & Die Corporation, Greenfield, Mass., have issued a new book, known as their catalogue No. 43. This book contains not only a detailed description of their line of gauges, but some mighty interesting and useful tables as well. To the mechanic, purchasing agent, etc., we can safely recommend the worth of this catalogue, for it will not only familiarize them with the Greenfield line of gauges, but act as a handy text-book besides.

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PRINCIPAL CONTENTS

Canada and Export

THE CANADIAN Industries Fair, which is being held in London, England, in June, will give Canadian manufacturers a good opportunity to put their goods before the buyers of the Old World.

Canadian firms should not go into any such a proposition with the idea that exhibiting their goods in London is going to establish an export trade for them. Exhibiting their goods at such a place is simply a step in the propaganda that will be necessary to secure a lucrative place in the foreign markets.

The first thing for any firm considering an export trade is to study the markets of the world. It is poor policy to think that they can speed up and produce a surplus that the foreign trade will absorb. The foreign buyer is just as particular as the buyer in Canada. He wants goods that are suitable to his climate, to his conditions, or to his plans of carrying on his business, and any or all of these may be quite foreign to Canadian conditions.

We very often have examples of this in Old Country firms trying to cater to the Canadian markets with something that they "thought" would suit the people here, or something they considered should be used here.

It would be good business for any Canadian firm considering export business to analyze the foreign market before making a move. Select a field that looks likely, secure the necessary channels of distribution, and then make a dead set on that territory. It is, according to the experience of men who have been through the mill, better to concentrate on some given territory than to so spread effort around that it becomes so thin as to have neither force nor staying power.

Enthusiastic—Sometimes

THE WHISTLE blew in a Toronto industrial concern a few days ago, as it has done for a good many years. There was more action in the next three minutes than there had been all day, with the possible exception of the noon scramble.

There was vim, ginger, push, pep — all these things and more — crowded into the few brief minutes following the tooting of the whistle.

A few nights ago young men started to line up outside the box office where tickets were going to be sold at 10 o'clock the following morning for a championship hockey match.

They stood in line all night and kept on standing until 10 o'clock in the morning.

There was surely perseverance, determination, and a keen desire to succeed in this demonstration.

But why is it that certain of us can pump up a heap more enthusiasm around quitting time, or over a hockey match, than over the great big task of making a success of our daily work?

Certain it is, were the same steam turned into business as was turned into the 5 o'clock quitting hour or the all-night stand for a hockey ticket there would be much greater successes and fewer people tossed out into the discard as very average or no good at all.

Essential or Not?

THERE is an increase in the number of those who are not performing any necessary service. Offices in Toronto and other cities are scarce — very scarce — because there are processions after them.

It seems to be an easy matter for a person to worm themselves into some little agency, where their chief function in reality is to get in the line of distribution between the producer and the consumer.

During the war the United States authorities went through the land, and arbitrarily called a business essential or non-essential. There were some surprises then. It will be recalled that the gatherers of scrap metal were classed as doing a necessary work, while some very prosperous-looking establishments were passed up as being quite unnecessary to the carrying on of business or United States' participation in the world war.

It would not be an unmixed evil were the substantial business fabric of the Dominion able to shake itself sufficiently to cause a number of the barnacles to drop off.

There seems to be no way of keeping a number of seemingly important little chaps from crowding themselves into the business world in one useless capacity or another.

There are many ways of writing and concluding letters with a punch, but one from a brokerage firm has this compelling farewell: "Hoping to be able to make some money for you. . . .," etc.

The war is pretty much over in various corners of Europe, but we are approaching the season of the year when the speckled hen is apt to get over the fence and make a frontal attack on the neighbor's Dutch setts.

The speculator and the premium operator are doing mighty little to help the consumer of iron and steel when he most needs help, which is right now.

It is very easy to figure out that prices cannot possibly go any higher, only to come down to the office and find announcement of 'steen lines that have hopped over night.

When you see a man on the street with grey socks in this windy weather, and on the same street see some girl with silk hosiery — well, one's got too much on or else the other's not got enough. Great chance for a rather illuminating argument here.

OUR BIG CHANCE IS IN DEVELOPING CANADA

Lloyd Harris Speaks at Brantford Regarding a Greater Degree of Business Independence

LLOYD HARRIS was the speaker at the Brantford Travellers' Club in that city on Saturday afternoon. He reviewed, with many interesting incidents, replete with humor, his thirty-five years as a travelling man, for as he said, he was still a salesman and always intended remaining one. His first mission outside of the Dominion had been when he took over the chairmanship of the Canadian War Mission to Washington in 1917. At that time, the United States, having just entered the war, Canadian munition manufacturers were in grave danger of losing their trade. Commercial relations with the United States became strained and it was difficult to obtain raw materials from the other side. Restrictions were placed on imports coming from Canada and the country needed representation at Washington to show the Government there the true status of Canadian manufacturers. Americans could not believe that Canadians could turn out quite as good products as they. With the aid of a few typical travellers of this country the trade commissioner had gone to the States and secured immense orders at a marginal expenditure. In fact, the costs of securing the war orders for Canadian manufacturers had been only a fifteenth of one per cent. of the amount of the orders. Though the American Government had the interest of their people at heart they had not shown the best business insight in their initial systems for placing war orders. It was the typical Canadian traveller who had convinced the Americans that it was a poor policy to refuse Canadian war contracts.

Dependent on United States

Impressions formed by Mr. Harris while in Washington were that Canada had grown up dependent largely upon American manufacturers, to a degree similar to Britain's dependency on Germany for many products at the outbreak of the war. The mihsion at Washington had to use the most compromising judgment in licensing war orders for Canadian firms, and in some cases refuse to endorse them.

Must Develop Canada

"We must develop Canada, our own resources and manufactures, so as to make us as independent as possible," said Mr. Harris. The simplest source of supply had too often been the United States. Neighborly relations with the Americans were to be greatly desired, but the two countries had so little in common in the way of manufacturing industries there was every reason for them remaining independent of each other.

"This talk of free trade with the United States can only lead to one thing — political union with that country," the speaker pointed out, and this condition was scarcely thought of by either country.

Trade With Europe

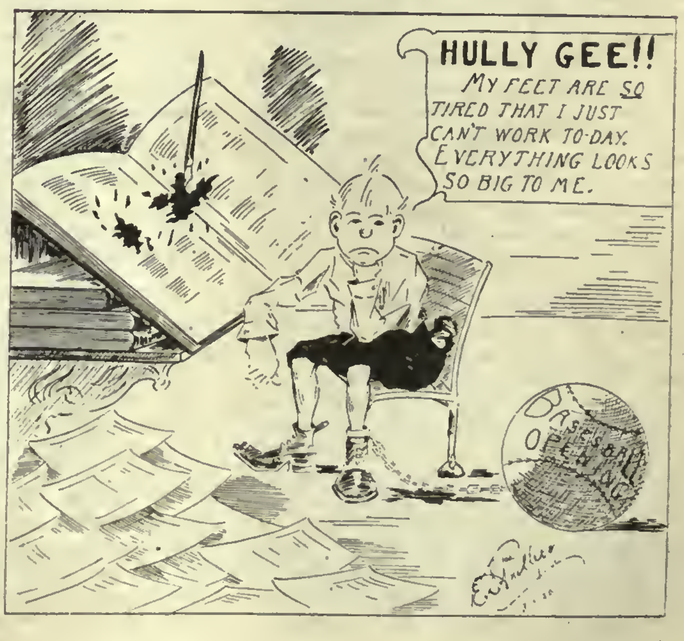
Leaving Washington suddenly at the signing of the armistice, Mr. Harris had gone to London as chairman of the Canadian Trade Mission. Trade interests there demanded Canadian representation, and the mission was able after a certain amount of educational work to secure considerable British and European trade for Canadian business. Manufactured exports from Canada have been increased sixfold since before the war, and there was every reason to believe that that mark could be kept up for years to come. Bureaucratic stupidity had been responsible for a ban being placed on Canadian-made goods sold to Great Britain when the war ended. The British Ministry had to be shown the folly of such a measure and the Canadian mission was able to do so. Canadian goods had now an established preference in England. While in London the mission had entertained many peace delegates and other representatives from many nations. Canada's reputation as a warring nation had awakened the confidence of the world and orders for Canadian-made goods could be had for the asking. The chief trouble was that the supply would not meet the demand. Manufacturers in this country had been busy developing the domestic field without paying much attention to the foreign market. The speaker emphasized the necessity of the business men of the Dominion studying the markets within the British Empire. This was the choicest field for Canadian products and intercolonial free trade would be a great boon. At present the British people in all parts of the world were commencing to learn the advisability of educating themselves to each other's interests, resources and abilities.

The Gold Coast Field

Canada could, for instance, find an excellent market in the Gold Coast, a hitherto unknown and undeveloped colony. They now had a Canadian-born Governor there, who had in his time been a traveller and salesman of ability, and Canadian-made goods were greatly in demand. Mr. Harris had unofficially discussed intercolonial free trade with the Premiers of the greater colonies, and all expressed the opinion that it would prove of undoubted benefit to all.

Efficient Leadership

Speaking on the problems presented by Governments, Mr. Harris gave his views as a citizen toward the present leadership in Canada. He expressed his desire for a safe, sane and sound Government, with efficient leadership. The national debt amounted to $200 per capita, while the resources of the Dominion amounted to $2,000 per capita. An efficient Government would seek to develop these resources and pay off the debt at an early date, but under the present administration this could hardly be expected. Properly developed, the steel industry alone would make Canada independent of the other countries. Other industries need correct manipulation, some to be developed enormously, and restrictions carefully prepared for others. The pulp industry was an example of where immediate restrictions were necessary. Canadians in general had always expected too much from all Governments, which they blamed for a multitude of things. The Governments had attempted many more projects than they should try. Greater individual effort would eliminate a great deal of this useless investigation. The Government must restrict itself to straight business projects that concerned the best interests of the people. Legislation would have to be enacted to make available equal opportunities for all. Men of ability could, therefore, get ahead when they deserved to.



MARKET DEVELOPMENTS

Getting Tired of the Premium Operators

There is a Growing Feeling That He Has Gone His Limit and That Any Change Now Will be in Favor of the Consumer—High Prices for Some Jobbers' Lines

PRICES continue to provide considerable speculation in the steel and iron markets. Quotations given by jobbers and warehouses are for the most part purely nominal. The supply in many lines is so uncertain and resort has to be had to the premium market so frequently, that each shipment and each sale is tied with a set of conditions all its own, and it is on these that the price is placed. The trade is becoming weary of the operation of many of the premium channels, and it looks as though, in nearly every line they had reached their peak, and whatever happens now will be in favor of the consumer. The Steel Corporation has notified its agencies that it will look after its customers, and that none of them needs to approach the point of suspending operations because they cannot get supplies.

Shipments are coming in more freely in all lines of machine tools, and supplies, due to better shipping; but it cannot be said that there is any improvement in the matter of schedules, which are still extended some months into the future.

The automobile, truck and kindred lines continue to stay in the machine tool market as the best buyers of material. Reports from New York markets this week seem to show a difference of opinion among dealers as to the sustained demand for machinery, some of them claiming that their experience shows a falling off.

Capacity operation of plants is reflected in the continued demand in this district for small tools and supplies generally. Prices for these lines remain firm, and it is understood that several of the makers of small tools contemplate putting large stocks in Toronto for distribution purposes.

OPENING OF MONTREAL PORT IS SURE TO HELP THE SITUATION

Special to CANADIAN MACHINERY.

MONTREAL, Quebec, April 1.—Apart from the evident irregularities that still exist in relation to car supply, there appears to be an impression that things are on the turn and conditions from now on will show steady, though perhaps slow improvement. Reports from the States would seem to imply that the supply of raw materials are more adequate and that production has increased in consequence. Local mills and steel foundries are operating close to capacity, but are frequently handicapped by the irregular shipments of material. Dealers in iron and steel commodities are optimistic regarding early future conditions, but do not anticipate any marked relief for some time to come, owing to the fairly heavy requirements in various lines of industry.

The effect that the new plate mill at Sydney will have on future steel trade is the fact that regular shipments of steel plate from the mill to British and European points will be an important branch of the company's business this year. The car situation is still one that interferes with maximum transfer of freight, and Canadian shippers are still having considerable difficulty in keeping goods moving to the States. With the opening of the port here, pressure on the railroads will be relieved, but the exact date of opening is still uncertain. The placing of heavy contracts for C. P. R. equipment will demand increased supplies of plates and shapes, and it is not unlikely that the upward price tendency will continue on these lines.

Tin a Little Easier

Conservative trading is still a factor in the movement of non-ferrous metals. Copper has taken on a stronger tendency following a comparatively easy period. The market, however, has returned to its former state of firmness and sales have increased. Tin shipments are quite regular and dealers are able to supply the present normal demand. Local quotations are slightly easier at 75 cents per pound. Lead is becoming easier, but other metals are firm.

Good Business in Rebuilds

Despite the continual advances that are reported from time to time on every line of equipment, the general demand shows no apparent falling off. Labor costs to-day are given as one of the reasons for higher prices, and this same condition may be said to be responsible for the maintained inquiry for modern machine tools. It is the belief of many manufacturers that lower cost of production may be had by increasing the facilities for greater output, a condition that is only possible by installing such up-to-date equipment as will counteract the higher wage scale that is the basis of increased costs. The business carried on in used machine tools is of considerable volume, and many firms are actively engaged in rebuilding equipment for supplying the heavy demand that now obtains. In many instances buyers will arrange for a rebuilt tool to tide them over until a new machine can be secured. There appears to be a considerable export trade at present from the States to Europe and the Far East, and this is sometimes given as the reason for delayed delivery on tools to Canada. Dealers report a steady movement of all classes of supplies, with English lines on the increase.

Uncertainty in Scrap

The week has developed no new features and the movement of scrap has been in less volume than for some weeks past. There is a steady demand for machinery scrap and the supply is inadequate to fill the full requirements of the trade. Dealers are dependent on the accumulation from varied sources as there is little dismantling of plants at the present time. Under these conditions the consumption of cast scrap prevents the possibility of stocking this material, the consequence being a very strong market with quotations of a nominal character. The mills are regular buyers of heavy melting steel and prices above $18 have been reported, but dealers state that definite quotations on any line are very difficult to state owing to the uncertainty that prevails in all lines.

CAN SEE NOTHING BETTER AS YET

Shipments a Little Better, But Accumulation of Orders Still Remains

TORONTO.—Deliveries in machine tools are showing some little improvement with the clearing up of congested winter conditions and the raising of some of the embargoes. But there is a great big improvement to be made yet. Actual delivery schedules to which the builders of machine tools will definitely commit themselves show little or no improvement. There is occasionally a chance machine that can be gathered in to beat the schedule, but that is not the usual experience. For instance, one Toronto firm had an opportunity to get a big boring mill on a ten-day shipment. They did not close at the time, and if they decide now to go ahead with their contemplated addition they will get some in August as the best delivery date.

The automobile business, in one way or another, is still the best buyer. Some of the existing companies have developments under way, while announcement is made that other concerns are going to start the manufacture of either trucks or cars.

The supply business is receiving a great deal of attention in this territory. It is rumored that several of the largest makers of small tools are contemplating putting large stocks in Toronto from which to serve this district. One firm has an expert in the city at present demonstrating drills, etc., in several of the shops. There is a good volume of trade passing in these lines.

Business All Holds Good

Toronto dealers who have returned from the U. S. steel district bring very ordinary reports of anything better for the future in the way of securing a better allotment of material for this district. There is no doubt that shipping conditions have been very much against a betterment of deliveries, but with the clearing up of the winter troubles a better schedule is looked for right away.

"There is one thing quite certain," stated one of the Toronto men who has just returned, "and that is that the trade in the States and here also is getting pretty well fed up on the treatment they have been receiving from many of the premium mills and dealers since there has been a shortage and demand. The brokers who pick up odds and ends hang on and live for one thing alone, and that is to squeeze out the last fraction of a cent to some customer who must have the stuff or close down."

The Steel Corporation, it is understood, have let it be known that as far as possible they will not let any of their customers be short to the point of having to cease operations from lack of material. To do this they are spreading their material over as far as possible.

Jobbers in this district, it may be stated, are trying to do the same thing. It would be no trick at all for them to clear out many of the much wanted lines at an attractive price. They have a long list of consumers, though, and they feel that it is up to them to do something for each of these.

Some of the speculators who have bought rather freely from the premium mills are having rough going. One agent took on quite a tonnage of black sheets at 8 cents mill. At the price he would find it necessary to put them up for re-sale here he is having trouble in making headway. Galvanized are at present the most demanded in the sheet family. There are many concerns that simply must have these or else close down. The fact that the price is high does not enter into the consideration in most cases. It is still possible to pass these increased charges along to the consumer. Some of the trade here are predicting galvanized sheets at between 15 and 16 cents before long. As the situation looks at present any price, on any prediction, is simply a good or a bad guess as the future may determine. Certainly there is small chance of anyone sitting down and figuring out how the market is going to turn.

Some boiler tubes are arriving this week, but against these shipments there is an accumulation of orders that soon take up the entire assortment.

There is not a great deal of material being offered for sale, although prices are attractive. The American market is showing strength, although there is not the labor available at a low enough figure to have a proper assortment. It is reported that some of the transportation companies are sending in material without much classification. As a general thing these companies adhere to the standard classification approved of by the Railway Storekeepers' Association. In that the classifications are carried almost to extremes, there being no less than 98 classes in which the discarded material is put.

Absence of sufficient scrap material in this country is causing some of the steel producers to look around for semi-finished material such as sheet bars, etc., at the U. S. mills, but they find little encouragement of service in the near future as the U. S. mills have been forced to turn away a good sized tonnage of sheet bars because their capacity cannot touch the demand.

POINTS IN WEEK'S MARKETING NOTES

The exact date of opening the port of Montreal has not been announced. It is certain to relieve a lot of congestion.

—

The C.P.R. orders for heavy equipment makes more business in plate, shapes, etc.

—

Some jobbers state that they would not be surprised to see galvanized sheets selling around 15 or 16 cents.

—

Speculators who took on tonnages of black sheets at 8c f.o.b. mills, are having troubles in arranging for their resale.

—

The premium market has gone to the limit in nearly every class, is the belief of the steel trade.

—

Automobile and truck propositions, and concerns allied with this business, continue to be about the best buyers in the machine tool market.

—

New York dealers differ in their reports of the present market. Some hold that inquiries are dropping off, while others claim that business is better than ever.

—

There is a nice lot of business going in small tools and supplies. Prices are firm at the new levels.

—

Some boiler tubes are coming in, but there is a large accumulation of orders against these shipments.

—

The Steel Corporation policy is to keep their customers going. They have asked their local office to inform them of any case where suspension from lack of material is threatened.

REPORTS DIFFER ABOUT INQUIRIES

New York Dealers Not Agreed Upon The Amount of Business in Sight

Special to CANADIAN MACHINERY.

NEW YORK, April 1.—The New York representative of one machine-tool manufacturer says that last week was one of the best he has had this year. On the other hand, some sales representatives point to a diminishing number of inquiries and sales. On the whole a fair amount of business is being done, though business is not nearly so active as during the first two months of the year.

The General Electric Co. continues to occupy a conspicuous position in the market, its purchases and inquiries in the past week being larger, perhaps, than that of any other Eastern company. Additional inquiries for the company's new Bridgeport, Conn., plant have been sent out and a list of tools has been purchased for the machine shop of the Edison Lamp Works Division at Harrison, N.J. The latter purchases consisted largely of milling machines, turret lathes and drills.

The Nathan Mfg. Co., New York City, has bought a list of tools for its 106th Street plant. The Federal Shipbuilding Co., Kearney, N.J., is buying miscellaneous tools.

Railroad business is not developing rapidly, but it is probable that the Lehigh Valley Railroad will soon close on thirty or forty machines, for which inquiries were sent out recently.

FANCY PRICES HAD MERRY LIFE BUT PROBABLY A SHORT ONE

Special to CANADIAN MACHINERY.

PITTSBURGH, April 1.—Production of pig iron in the United States in 1919 is officially reported at 31,015,364 gross tons, this corresponding quite well with the unofficial estimates. Production had been quite uniform in the three preceding years, at about 39,000,000 tons, but 1916 had the advantage by a slight margin. Thus there was a decrease of about 20 per cent. Productive capacity, however, had grown materially since 1916, being in 1919 in the neighborhood of 44,000,000 tons, so that production was only 70 per cent. of capacity. The strike which began September 22 is of recent memory, and naturally occurs as an important cause of the year's light production, but as a matter of fact the chief cause of the light production was lack of sufficient orders. By the time the strike was practically over pig iron had become very scarce, but if there had been no strike it might have been moderately plentiful up to the end of the year.

While the production of foundry iron in 1919 was less than in 1918 the decrease was not as great as the decreases in Bessemer and basic iron. The 4,916,758 tons of foundry and ferrosilicon produced in 1919 constituted 15.85 per cent. of the total pig iron production of the year, while the 5,145,260 tons of these grades produced in 1918 comprised only 13.17 per cent. of that year's production.

Of the 31,015,364 tons of pig iron produced in 1919, 22,325,137 tons were for the use of the makers themselves, while 8,690,227 tons were produced for sale, being in other words "merchant iron." Of this total 4,817,234 tons or 55 per cent. was foundry and ferrosilicon. The rate of production has been increasing sharply of late, and will probably very soon be over 40,000,000 tons a year.

Price Restrictions Off

By the order issued by President Wilson last week, all price and other restrictions come off coal and coke as of this date, so that April 1 sees an absolutely open market. Where this open market will find its level is more or less of a question, as the only thing that has seemed clear in the minds of the trade in the past few days is that prices will be very high. It is regarded as conservative to talk of coal at $3.50, it being stated that large operators desire to hold the market down to about that level, while the smaller operators may push prices for spot lots to considerably higher ranges. For Connellsville coke a price of about $9 is predicted.

The removal of price restrictions on coal will not of itself increase the production of coal, nor will the removal of price restrictions on coke alone increase the production of coke. Production of coal has been restricted almost solely by transportation conditions, and that is true also of coke. However, if there is a free market the steel interests that have by-product coke ovens can bid higher prices for coal, and there is no doubt that they will bid higher and higher prices for coal until they get all they require, and thus the output of by-product coke will be increased. As to Connellsville coke there will be no increase in production except such as comes from improving car supplies spring weather helping the operation of the railroads. As to steel mill operations, it is very expensive indeed for output to be restricted as it has been of late at certain works by shortage of coal, and it is cheaper in the long run to pay almost any conceivable prices for coal than to do without.

The removal of the price restrictions on coal and coke, therefore, is certain to be attended quite promptly by a very considerable increase in pig iron and steel production, even though production for three months past has been materially greater than was predicted. While there has been transportation difficulties they have not been as great as was feared, while in the matter of labor, the supply of labor, and labor supplies, have been decidedly better than was expected, and very nearly normal.

Third Quarter Steel

Several of the large independent steel producers are now definitely committed to a policy of selling their products quarter by quarter, opening their order books for delivery in one quarter just after the beginning of the preceding quarter. Thus within a few days several large sellers are likely to announce definitely to their customers the prices they expect on third quarter deliveries. These prices will not be higher than the general level indicated by 3 cents for bars, 3.10c for shapes and 3.25c for plates, while they may be lower. It is understood that some sales have been made to customers entitled to special treatment, perhaps at somewhat less than the prices just mentioned. These same independents used to sell much farther ahead, and it is an interesting question whether they are selling for shorter periods ahead now because they wish to restrict their obligations or because they see that the trade does not wish to commit itself so far ahead. It is stated that there has been a considerable volume of inquiry of late for third quarter delivery, but it does not appear that consumers were disappointed when they found that the mills preferred to hold off, as to all the trade, whereby one consumer would not be disadvantaged as compared with another.

Thus it can hardly be said that the forward market for steel products is particularly strong, and it is certainly not advancing. As for the market for prompt deliveries, it is distinctly easing off, with inquiry much reduced and with prices slightly on the down grade. All these trends are precisely what were to have been expected, for at the beginning of the year it was well recognized that there was an acute shortage of steel, caused chiefly by the strike, and it was commonly predicted that it would require about six months for the mills to catch up with the country's requirements. With production distinctly greater in the past three months than was expected, and with railroad consumption of steel in the next few months smaller than was expected by the buying trade (there having been fears on the part of many consumers that railroad demand would restrict their own supplies) the shortage is likely to be made up somewhat sooner than was expected, and the fancy prices are naturally marked for eventual disappearance. The real basis of the market is the Steel Corporation prices. Below that leval it is quite improbable the market will go for quite a time.

Pig Iron

It is between buying movements in pig iron, there being little inquiry for early deliveries and practically none for second half. As forward prices for steel products are not advancing to the levels recently shown by early deliveries, while deliveries are declining, it does not seem that steel producers who use purchased iron will be able to pay present pig iron prices and come out whole. As to foundries, they are not likely to buy for second half unless a fresh scarcity develops. Pig iron rarely declines when the market is dull, as there is no incentive to cut prices, hence the continuance of recent quotations is no particular evidence of strength. The valley market remains at $42 for Bessemer, $41.50 for basic and $42 for foundry, freight for Pittsburgh being $1.40.

ALCOHOL AS A MOTOR FUEL

Alcohol, which has been considerably discussed as the much-sought-for substitute for gasoline as a motor fuel, receives possibly more consideration than other proposed substitutes because there appears to be no limit to the possible sources of supply of alcohol.

The British Government, viewing with concern the rising price of gasoline, appointed a special committee to inquire into the production and utilization of alcohol as a motor fuel. This committee has recently submitted its report and we learn from "Power" that it found that while alcohol is obtainable from molasses, potatoes, wood pulp and other vegetable products, the yield, contrary to popular opinion, is not large.

The usability of alcohol in internal-combustion engines with a properly designed carburetor and slightly modified compression is well recognized, so that there is no obstacle from the engineering standpoint. It is purely a commercial problem. Owing to the somewhat lower heat value of alcohol a correspondingly greater quantity must be used per horse-power-hour, so that in order to compete with gasoline the cost per gallon must be proportionately less.—Houghton Digest.

CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Vol. XIII, No. 15. April 8, 1920

Solutions to Everyday Machine Shop Problems

Read These Shop Hints Over and Perhaps One of Them Will Help You Out of a Dilemma. The Subjects Are Varied, for We Even Include the Story of a Pastor Preaching a Mechanical Sermon

By DONALD A. HAMPSON

SOME straddle mills had been recut by the softening and re-hardening method. Ordinarily, we took the precaution to scrape the holes a little oversize before hardening, so the contraction would not make them tight on the arbor, but this time it had not been done. They needed the cutters in a hurry, and one of the men was told to enlarge the holes in any quick way that he knew of.

He knew a good way. Chucking a bar of cast iron, he turned a three-inch length to nominally 1½ inch diameter, the size of the arbors. Then he carefully tapered this finished section to a little under size at the end, running to a little over near the chuck—0.003 inch in each case. This was coated with oil and dusted with emery. One at a time, the cutters were placed on this lap and, while the lathe was running, a stick pressed down on them, using it as a back and forth, with a very slight pressure toward the large end. Ten minutes of this enlarged each of the cutters to the desired size.

The shop that saves its old and broken drills has an advantage over the one that does not. Suppose a special counter-bore is required for one piece or a hundred. Pick out an end of a drill of right size, soften it, turn the proper size of heat, and re-harden. Or, if grinding facilities are available, do the whole job in the single grinding operation. In either case, you have the tool, shown by Fig. 1—rugged, cheap and free cutting. The angle of the twist insures this latter quality. And for abuse, a drill, or the remains of a drill, will stand more than any tool we may turn out of a bar of carbon steel and harden, at an expense of several hours' labor. Then, if a tool is wanted to square out the bottom of a drilled hole, one of these discarded drills may be ground off flat on the end, after which a clearance is ground back from each edge, and behold! The nicest kind of a square bottoming tool is ready. It does not take long to collect a full set of these for all diameters up to an inch by sixteenths.

In shops doing engine work, one of the frequent tasks is fitting up eccentric straps, planing off at the centre so the halves can come together. Usually made entirely of cast iron, the parts are scrapped after they have been worn and planed down considerably. It is possible to do as was done at Fig. 2. This consists of boring out the strap, babbitting it, and boring again to fit the eccentric. By undercutting, or dovetailing, as shown, the babbitt is well anchored. The divided construction of the strap makes it possible to hammer in the babbitt before boring, thus producing a high-class job and one that will prolong the lift of the strap indefinitely.

Where soft lathe centres are used, the cost of renewal amounts to considerable for a year's service. Hard centres do not need trueing so often, neither is the pastime of turning down the centre followed so frequently. Inserted points will cut the cost of renewal, as well as avoiding the job of turning and fitting tapers, which, somehow, no one seems to like. The centre in Fig. 3 is made with a piece of ⅜ inch drill rod set in the business end. This may be projected, when worn down, by putting a spacer behind it—up to the time when it is too short to be stable and must be thrown away. But it is so simple to put in a renewal that no one minds it or the loss of a stubby end of tool steel.

We attended a church service a while back, and, by luck, struck a good mechanical sermon. The pastor took for his topic "The Homely Virtues." These were: Orderliness, Common Sense, Thoughtfulness, Observation, Politeness and Push. We had expected to be bored, but instead we were cheered; yes, cheered to think that someone else (and outside of a machine shop) valued these qualities of person as we did; for if ever there is a business that demands these, it is ours. Give us a boy or a grown-up with these virtues and it is not necessary to ask about mechanical skill or ability—that follows quickly and as a matter of course. And the greatest of these is orderliness.

Smith & Smith were making a combined square and protractor for carpenters' use, a tool that included the functions or mitre square, rafter square, and protractor withal. A dial or rule was stamped along one edge, this dial being the familiar foot rule graduated in eighths of an inch. To do this work better and quicker than by the use of hand stamps, a machine was built. It followed the general lines of roll marking

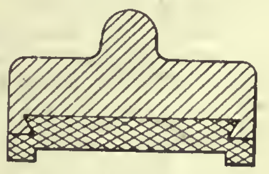
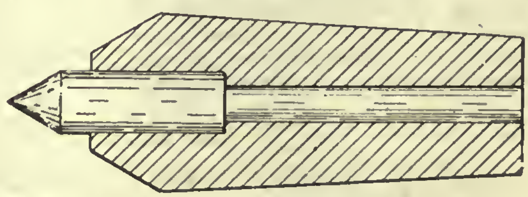




FIG. 1—USE FOR OLD DRILLS. FIG. 2—RENEWING WORN ECCENTRICS. FIG. 3—ECONOMICAL LATHE CENTRE.

machines. The task of getting an accurate roll stamp, or die, will be of interest.

This was made of a 1 in. thick disc of Champion non-changeable steel, oil hardening. The measurements are shown in part by Fig. 4. It was determined that the depth of the graduations in the finished pieces would be 1-64 in. and a "pitch diameter" was selected upon this basis. Instead of making the circumference of the pitch circle 12 in., graduations were cut to

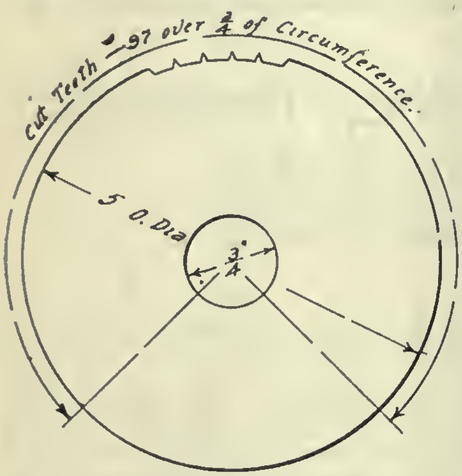


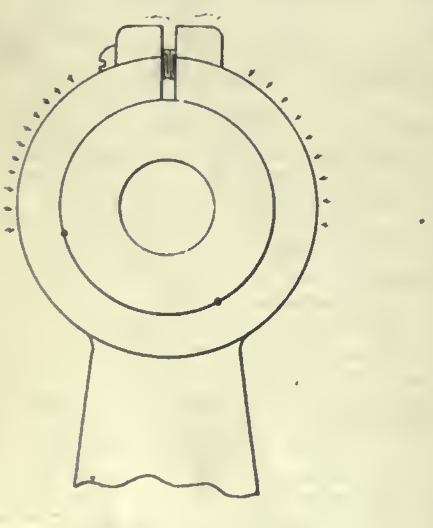
FIG. 4—DIE FOR A ONE-FOOT STEEL RULE.

roll the twelve inch dial only (beginning at the proper point), and a convenient blank space left over. The teeth were milled with the blank on centres, selecting an index circle that gave us 97 divisions in about three-quarters of a circumference. By actual measurement before and after, there was not 0.00025 change in size after hardening—and the dial as rolled matched perfectly with a B. & S. rule, tested under a glass.

Worn-out reamers may be restored to life by the following method: Anneal, by heating to a dull red and allowing to cool in the air. Then, with a swaging tool, which may be a chisel ground off flat on the edge, go over the front of each tooth of the reamer and hammer back on the cutting edge. Almost before one gets started, the diameter has been increased 0.005 in., because this driving back swells the metal on the edge and it can go in but one direction. After hardening and tempering, the tool is reground and is as good as ever. Or, if the worn tools have been replaced with new ones, this process may be resorted to to make a set of over-size reamers—handy in any shop. If a number of reamers are run through at once, the cost will be but a fraction of that for new tools.

Often the casting surrounding the drill press quill has been taken up to the limit of what the binder screws will draw. Still the quill is a loose fit, permitting sway to the spindle. If the casting be peened as shown by the arrows, Fig. 5, the divided part will be drawn together of its own accord and the screws may be further tightened.

One of the handiest fixtures to use in connection with face plate work is the V angle plate shown by Fig. 6. Not only for face plate work, but for many jobs that are done in the lathe chuck and with steady rest—for work of its class, it is better than the chuck for long pieces and better than the rest for short pieces. Boring, facing, drilling, and turning are among the principal uses found for the V plate. Rectangular-shaped parts are gripped as easily as round ones. Where there is no lathe in a shop having a hollow spindle, this attachment will do a large part of that class of work which has a small cross section and a length of several diameters and which requires machining at one end.



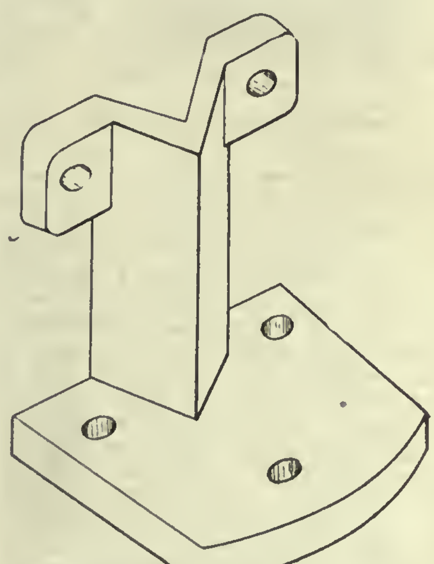


FIG. 5—CLOSING A QUILL BEARING. FIG. 6—THE VEE ANGLE PLATE FOR LATHES.

CAN YOU ADOPT THIS

In a certain plant there were several workmen who were habitually tardy, and one man in particular never seemed to be able to get to his job on time. When he came to work in the morning he usually showed up about fifteen minutes after the whistle blew and his tardiness was a source of vexation to the foreman.

One day the manager of this plant which had been experiencing considerable trouble in keeping labor decided to put in a bonus system to see if conditions could not be bettered. His plan involved the payment of a bonus of 10% of the weekly wages every Saturday to each employe who had put in a full week.

At first he was somewhat skeptical about it working as he had a number of negroes on the payroll who had been in the habit of working about four days out of every week. Much to his surprise the first week the bonus system was placed in operation practically every negro on the job worked a full week.

The second morning the bonus system went into effect, the tardy workman came in and punched the time clock at half-past seven. He had been out the night before and had not recovered from the effects of his dissipation.

The foreman who happened to be standing near the clock remarked in a very curt manner:

"Jones, getting in thirty minutes late this morning will cost you exactly three dollars."

"What do you mean?" asked Jones looking at the foreman in surprise.

"If you had worked a full week you would have received a bonus of $3.00 on top of your wages," the foreman explained, "but getting in late this morning knocks you out this week. Maybe next week you can do better."

The lesson had the desired effect. From that time on the tardy workman was one of the first on the job when the whistle blew.—Dodge Idea.

The exclusive sales rights in Canada of the Rego welding and cutting outfit and supplies manufactured by the Blastian & Blessing Co., Chicago, have been acquired by the Carter Welding Co., Toronto. The latter company will operate sales and service stations in the cities of Hamilton, Montreal, St. John, N.B., Vancouver, Calgary and Winnipeg, with headquarters in Toronto. Before taking over the rights of the Rego welding outfit the Carter Welding Company were sales agents in Canada for the Davis-Bournonville line of welding and cutting apparatus.

At the "Ideal Home" Exhibition recently held in London, Eng., one of the exhibits consisted of a modern house equipped throughout with electricity, not only for lighting but for cooking, heating (including the heating of water for kitchen, bathroom, and all other purposes) and the electric driving of vacuum cleaners, machines for washing dishes and for washing clothes, serving machines, and plate and boot polishing machines.

Interesting Data for Making Taper Reamer

Formulae for Calculating the Design of Spiral Taper Reamers is Herein Discussed. The Different Figures Given Are Derived From Practical Experience, So Should be of Special Value

By W. ERNEST

I HAVE looked up many handbooks for formulas for the calculations for making spiral taper reamers, without finding anything very definite, so I was driven to the necessity of fixing up some rules for myself, and I pass them along for your consideration. They may be useful to others, or perhaps someone else might suggest improvements on them. Let us suppose we are going to make a reamer to dimensions given in the sketch, Fig. 1.

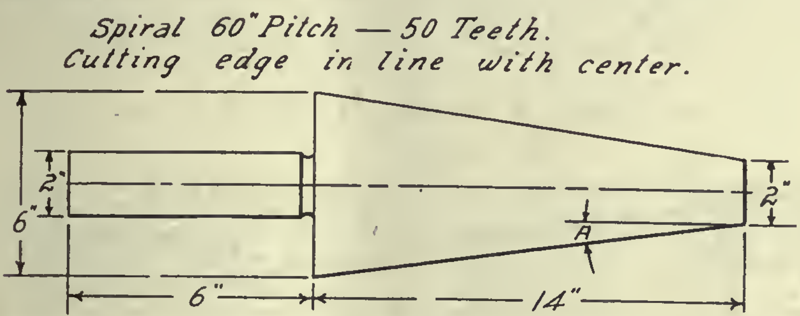


FIG. 1.

After cutting off and centering, the first operation would be to rough turn to within about quarter of the diameter given, then anneal before finish turning. This takes out the initial stress in the steel and gives you a better chance to harden the reamer without breaking the teeth, it being such a solid body and the teeth right up to a cutting edge there is a great danger of breaking the teeth in hardening.

Next finish turning, leaving about .015 in. on the shank and from .015 to .020 in. on the body for grinding or a little more according to your facilities for hardening, as the reamer never runs perfectly true after hardening. In turning the taper it is best to use the taper turning attachment if you have one. Some taper-turning attachments are graduated in taper per foot and some in degrees; if in taper per foot then the calculations would be:

Where D = Large dia.
d = Small dia.
L = Length of tapered part.

$$\frac{D-d}{L} \times 12 = \frac{6-2}{14} \times 12 = 3\frac{3}{7}'' \text{ per ft.}$$

FIG. 2

If in degrees the number of degrees would be:

$$\frac{D-d}{2} \div L = \frac{6-2}{2} \div 14 = .1428 = \tan. A.$$

FIG. 3.

Angle with Centre

Tan of .1428 = 8° 10′ as near as the lathe could be set.

If it is necessary to shift the tailstock centre we must remember that when the piece is revolved the same cut is made on all sides so that when we find the amount of taper the tailstock must be set over one-half. If D equals the large diameter and d the small diameter of the tapered portion, L the total length of the piece and l the length of the tapered portion, then the offset x of the tailstock is determined by the following formula, shown at Fig. 4.

$$x = \frac{D-d}{2} \times \frac{L}{l} = \frac{6-2}{2} \times \frac{20}{14} = 2\frac{6}{7}$$

FIG. 4.

In the actual turning there is one point worthy of mention, that is the tool must be set exactly the height of of the centre of the lathe, and if taken out to sharpen must be set back to the same place. If the tool is set either above or below the centre it will take more off the big end. The sketch will make this clear. The large arc represents the big end, the small arc the small end, and A the path of the tool on the centre line; now, if the tool be lowered to line B it will be seen it is nearer to the large surface than to the small one, hence it would take more off the big end than the small one, see Fig. 5.

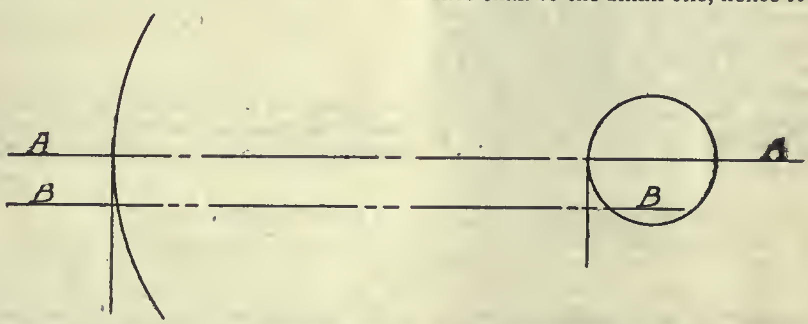


FIG. 5.

$$\frac{60 \times 4}{40} = \frac{6}{1} = 6:1$$

$$\boxed{\frac{75 \times 60}{25 \times 30}}$$

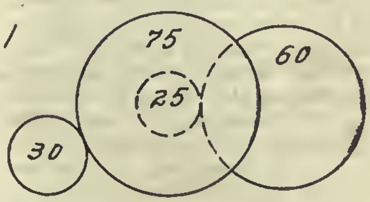


FIG. 6.

Now our lathe work is finished we will proceed to set up the miller. The pitch of the spiral is 60 inches. In setting up a miller for milling spirals there are two indispensable factors we must find out.

(1) The pitch of the feed screw.

(2) Number of revolutions of index crank to turn work around once. Suppose the feed screw is ¼ pitch and it makes 40 revolutions to turn the work round once, this table would advance

$40 \times \frac{1}{4}$ or $\frac{40}{4} = 10$ inches. This is called the lead of the machine. From this explanation the following universal rule is deduced: Multiply the lead in inches to be cut by the number of threads per inch of feed screw and divide by forty. See Fig. 6.

Or any set of wheels that have a ratio of 6 to 1 either single or compound.

Next let us calculate the divisions of our index plate for cutting fifty teeth.

How to Use Index Plate

Since forty revolutions of the worm shaft give one turn of the work, then one turn of the worm shaft would give $\frac{1}{40}$ turn of the work and would divide the work into 40 equal spaces. From this we deduce the following rule: Divide 40 or the number of turns required for one turn of the work by the number of divisions into which the work is to be divided and the resulting fraction will give the number of turns or part turns which the index crank must make to obtain the desired result. Thus:

$\frac{40}{50} = \frac{4}{5}$ of any chosen circle.

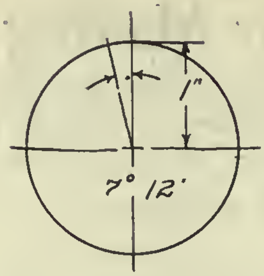
Next we must move the table round so that the line of the cut will be as nearly as possible in line with the milling cutter. This is found by dividing the circumference, taken at the centre in a taper reamer by the pitch of spiral; this will equal the tan of the angle, and by looking up a table of tangents we get the degree at which to set the table. The diameter in the centre is 4 in., the formula therefore would be, as shown at Fig. 7:

$$\frac{4 \times 3{\cdot}1416}{60} = {\cdot}209 = \tan.\ 12^\circ$$

FIG. 7.

by reference to table equals 12 deg. nearly. Now it is evident that this being a taper job that one centre will be higher than the other, also it is imperative that the centres should be in line with each other, that is, pointing directly toward each other. If not, our teeth would not be equally spaced, and we should have wide landings on some teeth and no landings at all on others. Also our cut must be deeper at the big end than it is at the small end in order to leave our landings parallel; this being the case, we will work out the depth of cut and get the angle and height of the centre. The depth of cut can be found as follows: Dividing 360 by number of cuts gives us the angle with the centre. Multiply tan of angle by radius equals width of cut.

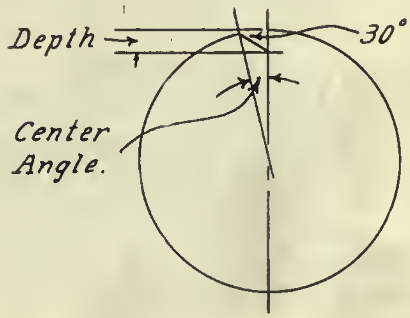
If we are using a 60 degree cutter the tan of the opposite angle 30 degrees, multiplied by width, will equal depth. The depth at the large end. This will be the tan of 7 degrees 12 multiplied by radius multiplied by tan of 30.



$$\frac{360}{50} = 7^\circ\ 12'\ \text{Ang. at center}$$

$$\text{Tan. of } 7^\circ\ 12' \times \text{Rad.} = \text{Width of Cut.}$$

FIG. 8.

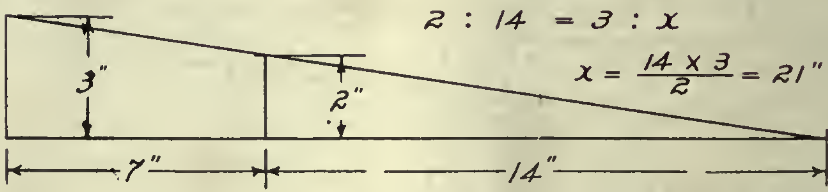


$$\text{Tan. of } 7^\circ\ 12' = {\cdot}125$$

$$\text{Tan. of } 30^\circ = {\cdot}577$$

$$ {\cdot}125 \times 3 \times {\cdot}577 = {\cdot}216$$

FIG. 9.



$$2 : 14 = 3 : x$$

$$x = \frac{14 \times 3}{2} = 21''$$

FIG. 10.

If we set the machine at the correct angle we need not consider the depth at the small end as it will automatically adjust itself. The depth of the cut at the large end will be .216; if this cut was continued until it ran out to nothing it would run out at the point where the surface of the cone and the centre line would meet. The length of this centre line can be found by simple proportion, thus: If the centre line is 14 in. long in a 2 taper, how long will it be in a 3 taper? See Fig. 10.

Or by using our previous calculation which we made for the lathe. The side opposite, that is 3 in. divided by the tangent of 8° 10′, equals the length of the centre line.

$$\frac{3}{{\cdot}1428} = 21''$$

Now, by deducting the depth .216 from the radius 3 in. we can obtain our angle for the centres, see Fig. 11.

Angle of centres 7° 30″ nearly. There is still a chance for a serious error: the tail of centre may not be at the right height. The difference in height from the table would be the tan of 7° 30′ multiplied by the length of the work or the distance apart of the centres.

$$132 \times 20 = 2.640$$

This is neglecting the depth of the centre holes. If extreme accuracy is required the depth of the centre holes must be allowed for.

After adjusting machine to these requirements, set the sharp point of the cutter exactly over the point of the centre; we are using a 60 degree cutter with angles of 48 degrees on one side and 12 degrees on the other, as this is found by practice to give the best results. Now lower the table and place the work between the centres, start up the machine and raise the table until the cutter just touches the work at the large end. Now the work must be pushed over to one side until the edge of the cutter which forms the cutting angle makes a straight line with the centre when it is

$$3 - {\cdot}216 = 2{\cdot}784 \qquad \frac{2{\cdot}784}{21} = {\cdot}132 = \text{Tangent.}$$

FIG. 11.

at the required depth; this can be found as follows:

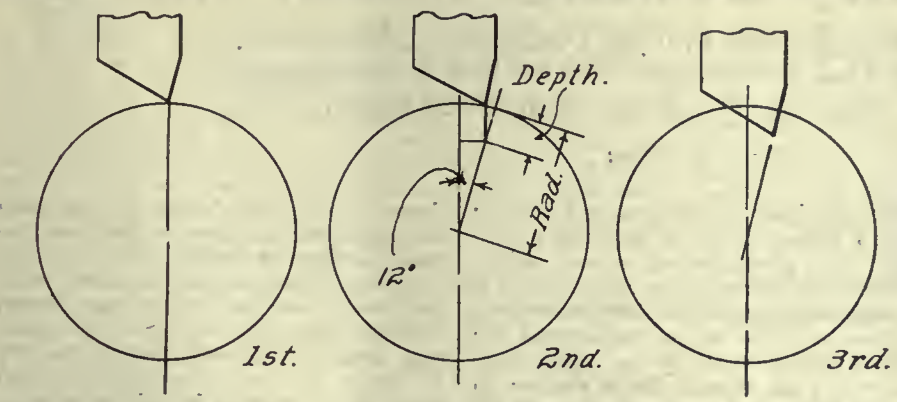


FIG. 12.

1st position has already been set by placing edge of cutter over centre; 2nd position, since the edge of the cutter makes an angle of 12 with the centre line. The side movement of the work will equal radius-depth times sine of 12:

$$3 - .216 = 2.784 \qquad 2.784 \times .2079 = .578$$

FIG. 13.

The depth of tool from centre line or amount to raise the table will equal radius-depth times cosine of 12 equals side adjacent. Radius-side adjacent equals depths from centre line.

$$3 - .216 = 2.784 \qquad 2.784 \times .9781 = 2.723$$

$$3 - 2.723 = .277'' \text{ Amt. to raise table.}$$

FIG. 14.

No other calculations are necessary and we can go ahead with a reasonable certainty of making a good job. This may not be the best method, but it is the way it looks to me. If any of my fellow readers have different methods let us have them, as an exchange of ideas is mutually profitable.

PONTOONS CARRY PORTABLE PNEUMATIC CAISSON

A portable pneumatic caisson mounted upon a pair of pontoons and designed for the recovery of diamonds from the deep pools of the river Naal, is described in the "South African Mining Journal."

A metal cylinder or bell having a dome roof, which is surmounted with a tubular shaft in sections to suit depth of water to be worked, is terminated by an air-lock chamber surrounded by a water ballast tank. The dome roof of the bell is provided with means of securing, and at will releasing, a quantity of solid ballast. The tubular shaft is furnished with external runners which engage in rollers or guides attached to the deck of a pontoon or raft which carries an engine, air compressor and centrifugal pump, and possibly plant for the treatment of the gravel or material recovered. The air-lock chamber is provided with the usual manhole door and equalizing valve, together with an air-lock chute for discharging gravel; a special door closing the entrance to the tubular shaft, which latter is furnished with ladder rungs and runners for skip way, operated by a hoist fixed in the air-lock. The base of the shaft where it enters the bell is fitted with an air-tight door which may be used when it is required to lengthen the shaft. The bell is provided with collapsible seats attached to the wall for the accommodation of workers during lifting operations, and with a centrifugal pump or hydro ejector having a flexible suction by means of which the loosened gravel is deposited in the kibble or skip hoisted to air-lock or elevated direct above water level to the deck of the pontoon.

Method of Operation

Sufficient solid ballast to partially submerge the bell is placed on the dome roof, water ballast is then pumped into the tank surrounding the air-lock in order to sink it and hold it securely on the river bed or sea bottom, and the gravel is elevated to the surface by pump or ejector direct, or hoisted to the air-lock and thence discharged through the air-lock chute projecting through the water ballast tank. The bell, or caisson proper, is fifteen feet in diameter, five feet high, and has a cone roof rising to eight feet six inches; the interior is fitted with electric light in a water-tight fitting, and has a telephone communicating to the air-lock and engine-room. A specially-designed hydro ejector with a flexible suction is installed for clean-up purposes. The apex of the cone roof is surmounted with an M. S. collar-piece to which the various lengths of the shaft are bolted. The shaft is two feet nine inches interior diameter and is made in lengths varying from five feet to twelve feet; each length is furnished with ladder rungs and steel runners for skip, also with an air-pipe and five core armored cables with G. M. couplings for electric light, telephone and signal bells. The air-lock is six feet six inches in diameter and six feet six inches high; is fitted with the usual manhole and shaft doors, equalizing and relief valves, and is placed inside the water ballast tank, which is ten feet ten inches in diameter. Through the wall of the air-lock chamber and ballast tank a gravel chute projects at an angle of 45 degrees; this is closed at either end by air-lock doors, the outer one being of special construction fitted with a positive interlocking device which prevents its being opened until the inner door is closed. An Ingersoll air-hoist, operating a ½-ton skip, raises the gravel from the caisson and tips into the chute, which has a capacity of 1⅛ tons. From this chute the gravel is discharged into a bin on the deck of the pontoon, and thence elevated to a trommel, whence it is delivered to gravitator. The pontoons are 37 ft. x 10 ft. x 2 ft. 6 in. and are connected by platform decks 37 ft. x 10 ft., thus forming a square, in the centre of which is a 17 ft. x 17 ft. opening to admit of the caisson being raised for transit in shallow water. A heavy gantry standing on columns is rigged for the purpose of raising and lowering the caisson. The deck plant consists of a vertical boiler, Laval steam turbines, air-compressor and receiver.

An important step toward the further development of British foreign trade is indicated in the plans announced by the University of London for establishing degrees in commerce. The National Foreign Trade Council learns from London that it is proposed to institute a 3-year course of study leading to the degree of bachelor of commerce. The addition of a minimum of two years' practical experience in the particular trade or industry selected would qualify the candidate for the degree of master of commerce.

The work of the first year would comprise the compulsory subjects of organization and industry, banking, trade and transport, elementary economic developments of the British Empire and chief foreign countries, commercial law and statistical methods. The second and third years would be devoted to specialization.

The scheme has the warm support of representative men in Britain's foreign trade, who are urging all business men to contribute liberally in support of this programme in order to secure for British commerce the advantages of a thorough and recognized commercial training

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Want Equipment.—The Lignite Utilization Board, 80 St. Francois Xavier Street, Montreal, is in the market for two belt conveyors, two bucket elevators, three screw conveyors and one wire mesh conveyor. Specifications may be had from the secretary, Leslie R. Thomson.

A Swedish scientist has produced a flame with a higher temperature than that of oxy-acetylene and has also devised a burner employing powdered aluminum and oxygen.

Canadian Machinery Drafting Course, Part XII

This Portion Goes Still Further Into the Designing of Miller Vise. It is Very Essential That Instructions Are Followed Out Closely, as It is the Principle We Wish Students to Grasp

By J. H. Moore

As a general rule, one would not start in to design a milling machine vise by drawing up the details, as we did in our last plate, but no doubt students can readily understand that our object in first drawing the details was in order to take up the more simple portions first.

When all is said and done, we are not designing this vise, but duplicating a type already in existence, so that our method of procedure is permissible.

Having already illustrated the details, we will now proceed with the base and its cap. Owing to the size of this portion, we suggest that the base be drawn half size; that is, to a scale of 6 inches equals 1 foot. The cap, of course, can be drawn full size.

We will make our plate size in this case 12 inches long by 8 inches wide to the border lines, with the usual ½ inch all round outside the border lines.

A good place to start in on the plate would be at the plan view of the base. Draw a centre line 5¼ inches down from the upper border line, and another line 6 inches from the left-hand border line. This gives students a good start.

The ensuing steps are optional, for it greatly depends on the draftsman what course would be taken, so perhaps our safest refuge would be to explain how we would do it, and leave readers to either follow out our method, or, if desired, their own inclinations. The result is what really counts, not the method of getting there, and it would be poor policy on our part to attempt to point out a hard and fast rule to follow. To proceed with how we would lay out this view.

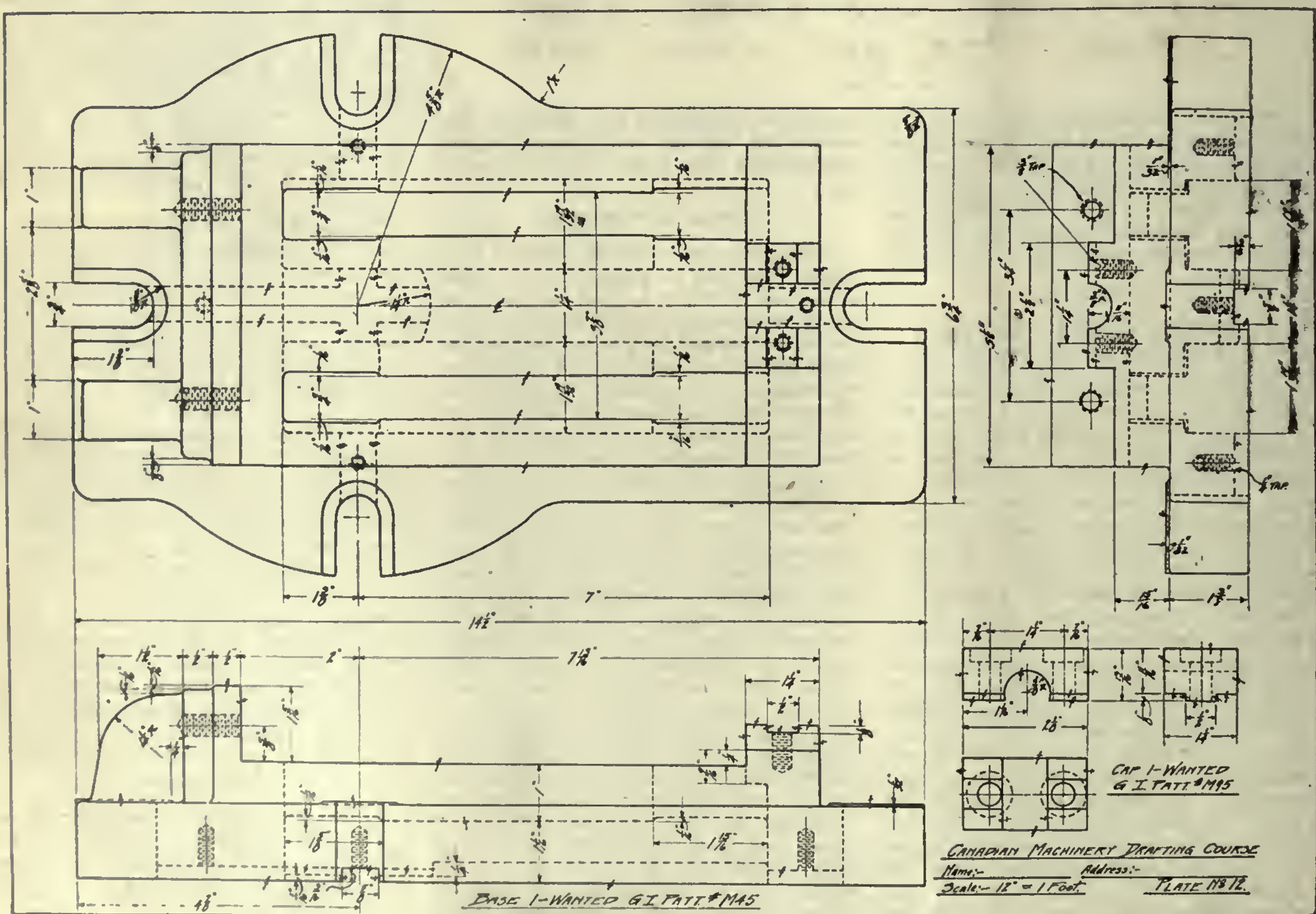
General Instructions

We would start from the intersection of centre lines drawn, and with a 4⅝ in. R describe two arcs to represent that particular portion of the base. Next draw two parallel lines 3⅜ in. on each side of the horizontal centre line. Now measure 4⅞ in. to the left, and draw a vertical line meeting these two parallel lines. Measure from this last line drawn a distance of 14½ in. and draw the other vertical line to complete the rough outline of the base.

Now set your small compasses to ⅜ radius and describe radii at each corner. Change your compasses to 1 in. radius, and describe the radii joining the 4⅝ in. radius portion. Of course it is understood that so far we have been drawing these lines lightly, for we take it for granted that students understand the advantage of doing so on any drawing before it is finally completed.

The next step would be to come in 1 in. from each end, on the centre line, and describe a ⅜ in. radius, and a ⅝ in. radius, continuing these lines to form the shape of slot, shown on the plate. The same procedure can be followed out for the two side slots.

Now lay out the top portion of the plan view by the same gradual steps. Draw lines 2 9/16 in. on each side of the centre line, and join to these lines, the various vertical lines at their proper positions as noted by the various dimensions. Having given students this much



AS SOON AS YOU RECEIVE THIS COPY, START ON THE PLATE. REMEMBER THE OLD SAYING ABOUT THE FELLOW WHO HESITATED.

of a start, we leave them to complete this view.

Either the side or end view can now be developed. In fact, some draftsmen prefer to develop views gradually, working from one to the other as they proceed with their designing. Had we been actually designing this portion of the vise, our method, no doubt, would have been to jump from one view to the other, until all were completed.

We will, for sake of example, start on the side view. Leave at least 1½ in. space between the plan and side view. Never crowd views too closely, but always leave room for dimensions. This may seem a small matter, but it is a most important one.

Draw all necesary parallel lines first, then join with the proper projected vertical lines, that is, the lines projected down from the plan view. Proceed as you did on the plan until you have finished this view. Lastly, develop the end view in similar manner, again leaving at least 1½ in. between views.

In this case, it would be wise to draw your main vertical lines first, after which project your horizontal lines across from the plan view.

Students will, no doubt, notice the difference between the end view and the plan and side view. By difference we mean the style of lines, etc. This has been done purposely, the end view being drawn by another party in order to illustrate the different methods of different draftsmen. Note the arrow heads. They are entirely different, being more splashy, and in some cases not touching the dimension lines. The figures also look different, as do the finish marks. In other words, each draftsman has his own particular style. Again, we repeat, "Always see that your arrows touch the lines; that your arrow heads are neat, neither too small or too large, and that every dimension is clear and distinct." Remember that a little extra time spent on the drawing will save considerable time afterwards in the machine shop.

Regarding the drawing of the cap. We leave this to the students' discretion, for when he has completed the base, he will be in good shape to tackle a simple part like the cap.

The Critic's Standpoint

They say that any old grouch can be a critic, but while we wish to be spared the name of grouch, let us go over the drawing, shown on the plate, and pick it to pieces. Starting on the plan view of the base, what do we find?

The first thing that the writer would say, is that some of his curves are not as neat as they might be. Make every curve meet into another curve, or into a straight line as neatly as possible. In some cases, where a great many curves occur, it is best to draw in the curves first, then joining the straight lines to these curves. The next point that could be criticized is the absence of certain dimension attention lines at the 1/16 in. dimensions. This is a small matter in this plate, yet an important one, in the case of a very complicated drawing.

We have also left off a finish mark at a rather important point, but, of course, it shows up in the side view, yet should be marked on the plan view, so get your eagle eye on the job, and remedy this point when you send your plate in.

The side view will, no doubt, pass, as it is not our intention to be over-critical. We have not the time to make a drawing of such minute perfectness to stand a close test for all small defects, besides the average drawing turned out in an office, could be easily picked to pieces, but yet is neat enough to serve its purpose. It is not necessary to spend a week on a drawing when a day is sufficient for the work. Learn to make a drawing neatly, but do not get the idea that neatness means to carry the effort to the extreme. Practice means perfection, and we feel sure that a good, serviceable, neat drawing will be made by our students in reasonable time before the completion of this course. While perhaps it may take you a little longer at present, do not get discouraged and rush matters, but rather take your time, turning out a drawing of which you can be justly proud.

Consisting the end view, we have various points on which we can safely comment. First, the dimension lines are too heavy, being practically of the same thickness as the rest of the drawing. Second, as before stated, the arrow heads are too splashy. Third, some of the dimensions are none too plain. Fourth, the various small curves do not meet in with the straight lines as neatly as they might. Fifth, the dotted lines are not as even as could be hoped for. Sixth, various small centre lines are left off the drawing, where, by a little extra attention, these could be added, making the view look more finished. This same condition is true of one part in our plan, which has been left so purposely.

Concluding this portion of the course, suppose we mention a few don'ts to students in general.

Don't be in a hurry.

Don't start any drawing before thinking out ahead, how you propose completing the plate.

Don't make your lines too heavy, but this does not mean make them too light, strike a happy medium.

Don't attempt drawing in curves freehand.

Don't make your dimension lines too heavy.

Don't make any of your lines rough and uneven.

Don't make your dotted lines of various lengths, long and short, and so on. Keep them as uniform as possible.

Don't write in the title; print everything.

Don't crowd your views, and above all don't lose patience if the drawing does not go as smoothly as you expected.

A good method to guard against all these above troubles is to see that your pencils are sharpened correctly, that your tools are clean and properly ground, and that you choose a suitable time to work on the different plates.

We want students to send in their work regularly, for otherwise we cannot tell what progress they are making. Next plate, we will take up another portion on this vise.

Cut out and send with drawing

Name ....

Address ....

Position ....

Firm's name ....

Segnite is the name given an explosive recently developed in South Africa by replacing the nitrate of barium in tonite by nitrate of soda. It is safe to handle and can be struck with a steel tool. It is equivalent in power to the same weight of gelignite.

Some elaborate tests, carried out by Mr. H. E. Doerr, chief mechanical engineer of the Scullin Steel Company, U.S.A., showed that in forging down an ingot of steel, at a temperature of about 2,250 deg. Fah. to 1¼ in. diameter, the density of the metal was increased, on the average, by 0.64 per cent.

In discussing the probability of oil being discovered by the borings now being sunk in Derbyshire, Mr. V. C. Illing, in "Nature," says: "The whole evidence of the geology, and the cumulative experience of the smallness and ephemeral nature of any oil occurrences which have been noted, agree in indicating that large commercial underground supplies of petroleum do not exist in this country. Small deposits have been found in the past, and will no doubt be found in the future, but the present search for large commercial supplies is not justified by the scientific evidence, though there is no doubt that the bores will yield useful scientific data."

A Large Wheel Job and How It Was Accomplished

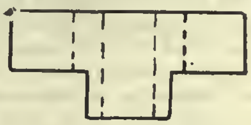
A Humorous and Interesting Story of a Happening in a Pioneer Machine Shop in the Far West. The Method Adopted to Machine This Wheel is Well Worthy of Note

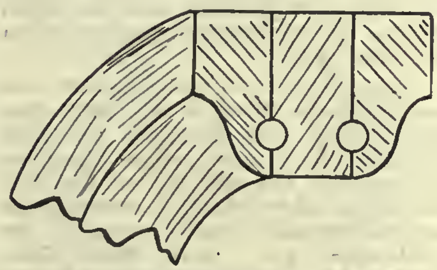
By W. R. GREEN

SOME few years ago, roughly about 1904, the writer was working in a fair sized machine shop and foundry, when the firm received an order for a large bull-wheel from a silver mining company a few miles distant. This wheel was to be the upper sheave and brake wheel for a cableway to take ore down to the railway tracks, as the road haul was too expensive. The company already had a cableway in operation but the upper wheel was found to be too light in rim section and would heat up very quickly when the brake was applied, so it was decided to get a larger wheel, which was to be 12 feet diameter, with rim 18 inches face by 6 inches in thickness, hub to be cored half its length and bored for 12 inch shaft, the length to be 24 inches; the whole thing to weigh not more than 6 tons and not less than 5.5 tons. The wheel was to be in quarters with a plain key in three of them and a taper key in one section. The sections were held together at the rim lugs by two bolts at each joint and two smaller ones at each joint were put through the hub lugs. One month after the patterns were made was the time limit.

Well, the moulders certainly had some trouble, but turned out perfect iron, and then our troubles started as the shop did not have a machine to work on the joints with, and that work had to be done by hand, and a sweet job it turned out to be, as the rim joints were stepped together as the sketch shows. I devised a template for the joint I was working on from a piece of cast iron, and shaped the piece in the shaper until it was the right size for the male, and the foreman then told me to make one for the female, so that we did not have to kill ourselves fitting the sections together but were able to make the parts fit to within a 32nd of an inch without actual trial. We got the joints finished and the bolt holes drilled and reamed, taper reamed at that to fit standard 1.75 in. big-end bolts at the rim and 1.25 in. taper bolts at the hub lugs, and then the real troubles began.

We had to bore that hub on a 12-foot wheel with a 6-foot face-plate lathe as a boring machine. Incidentally at that time I was the junior machinist in the bunch of six general men, and naturally did what I was told to do by the older men as well as the foreman, although the men were really good to me at that. Well, that job descended to me after all the others had tried with the lathe jacked up in the air and bedded on block. I am afraid I got the job through laughing at the way the whole rigging threatened to collapse. Anyway I told the foreman that if I was to take the job of boring the hub I would do it my way or nothing doing. He told me to go ahead and suit myself, which I did by first taking the lathe down off its stilts and having it placed on its own foundation again, then the floor was cut away and rigidly braced underneath, and the wheel placed in the gap and also braced and trued square with the face-plate and centred, the other men working loyally to help. After I started the boring, the other men were getting the shaft (hollow) ready to fit the plain keys, or feathers as we called them into it. Why there were three parallel keys and one taper key I have never yet found out. Well, after a time the bore was finished and the wheel taken out, and after marking the joints with numbers it was taken apart and the key-ways cut in the sections; they were not cut in the centre or each section but were put where they had a lot of metal ahead of them in their work of turning the wheel. After this keys were fitted to the hub portions and the wheel was put together for what was





VIEW SHOWING THE METHOD OF MATCHING THE WHEEL.

to be the last time in the shop. The keys were put in place and the taper given to me to fit a little better. After taking a shaving off it in the shaper and drawfiling it smooth, I applied blue marking to it for the last trial and tapped it lightly in when the foreman came along, and, seeing what I was doing, pulled me out of the way and told me that this was how they did things in the West, at the same time driving up the key with an 8-pound flogging hammer. Well, that was all right, but after putting the shaft and wheel on the old lathe and driving it with the face-plate rigged as a temporary chuck and the other end of the shaft riding on skids and well-soaped V-blocks, facing the rim and taking everything down again preparatory to freighting the sections to the mine we found that we could neither get the taper key nor any of the others out, and to make matters worse, we could not take out the section bolts. After many trials and tribulations in the endeavors to take it apart, I found that I was to be the goat, and the queer thing about it was that none of us remembered about the foreman driving in the last key so hard; this key, by the way, had a head on it of twice its own section, or about 2.5 in. x 2.5 in., the key body being 2.5 in. x 1.5 in. at the head end. The lug being for the purpose of drawing the key, and the plain keys being expected to slide when the other was drawn out. After the whole gang, not counting myself, had tried every way they could devise, including the use of 40 per cent. giant powder and also drilling with a ratchet, with no success, I was told that as I had caused the damage I could also repair the damage. After thinking over the job for all one day and finding that we had plenty of 12 in. hollow shafting in stock, I got the rest of the machinists and helpers to rig the wheel the same way as for boring in the lathe, meanwhile two men were to make four more keys and spline the new shaft in readiness for the finished wheel. It did not take as long to set up as before owing to the shaft being in the wheel, and it was placed with the short end of the shaft facing the face-plate, and all braced rigidly as for the first boring. The blacksmith was told to make three flat drill bits of stated sizes, which he did, and after I had rigged up a sort of driving drill chuck from odds and ends around the shop, my real troubles commenced, which made all the others look small by comparison, for I found that the drills were not like the boring bar had been, that is, they could not be fed into the work, so they had to be thrown aside and a small self-feeding boring bar had to be made in a hurry to fit a hole 4.5 in. in diameter, the internal bore of the shaft. We only had two screw-cutting lathes in the shop, so one man had to make the lead-screw and another had to make the feed nut, still another made the tool box and one made the star-wheel (strike wheel some call it), and I had to make the slotted bar on the shaper after drilling both ends for the feed-screw bearings. Owing to the fact that the shaft was not absolutely true internally, a leader guide or bushing could not be used until the first cut was made, and as the total length from the shaft end to the rear end of hub was 4 ft., you can imagine the way the boring bar sprung during the first cut, but after truing up the first cut we used the bore as a mould by plugging the hole with clay and centering a piece of shafting of the same size as the cutter bar.

One of us poured the mould full of hard babbitt, which, after cooling, was used as the guide bushing by pulling out the steel core and putting the head of the boring bar in it and jacking the whole thing back in the hole. The cutter having been turned back to the starting place by hand and the back end of bar placed in the chuck again, the lathe was started up again, and I found that on plain belt pull I was able to make a cut of about 3-32 feed by about a depth of 5-16 in. The boring took approximately one working day, the three men who were not doing the splining, etc., were so tickled with the job that they wanted to spell me off, and did so at dinner time so as to lose no time on the job. After the boring was done we fitted the new shaft and the keys, then took them out and disassembled the wheel; we found that every rim bolt looked as if it had only been rough-turned and yet the bolts nearest the binding key were in perfect shape. Well, after the whole thing was freighted out to the mine and put in its place the foreman told the main boss what caused the final trouble, he having remembered about drifting the key up tight. The boss came through with some extra cash for me and some for the men as a bunch. Then he told us that the profit did not matter on that one job as he expected he would get all that mine company's work in the future, which I think he did.

The old face-plate lathe had originally been shipped out from England for tire-turning in some railway shop and had been sold to our company as junk. It had a six-step cone and double back-gear, the shaft of the lathe was hollow with a taper hole through it being approximately 8 in. at the working face and 6 in. at the other. After the old shaft was cut away from the wheel I found that the taper key had buckled in the cored portion of the hub from drifting in the small end of it.

The Grinding of Rolls is An Art in Itself*

The heavy chilled iron or steel rolls used in the manufacture of armour plate, sheet metal and paper require varying degrees of finish, but in every case they have to be made perfectly round. They vary in size from 6 in. to 60 in. diam. and 8 in. to 15 ft. wide, and previous to the inception of the roll grinding machine presented a very tedious machining operation.

In this country the production of new rolls and the re-truing of worn rolls is, in the majority of cases, still carried out by the old method of turning, filing and polishing. Occasionally we find that some very inadequate arrangement has been made to grind the rolls in position.

A smaller number of British manufacturers, however, now realize that the desired surface can be obtained much more economically by finishing in a roll grinding machine than by the methods mentioned above.

Chilled iron rolls are very difficult to turn in a lathe owing to the nature of the material. In addition it is necessary to take cuts deep enough for the tool to get right under the "skin" of the roll, so that a fairly large proportion of the chill is thus turned away needlessly.

In grinding a roll no more metal is removed than is necessary to obtain a clean, true surface, so that very little of the chill is lost at each grinding and the roll may be trued up a number of times before the chill has disappeared.

Rolls finished in a grinding machine are perfectly round, and may be either parallel or cambered according to the requirements for their particular use. Ground rolls give a more uniform product whatever the nature of the material being rolled; in the case of tin plate, the even deposit of tin due to the more perfect rolls causes an appreciable saving in the tin used. A ground surface is very hard to file or scrape, and surface abrasion much better than a surface finished by filing and polishing. This property gives the ground roll a much longer life between each re-truing.

Rolls that require a turning operation before grinding, as when the deposited tin is removed from tin plate rolls, should be rough turned in one traverse at about eight cuts to the inch; the general procedure is to remove this tin with a traverse as fine as 40 cuts to the inch, so that the surface obtained may be more easily filed up, but the coarse finish will be quite suitable for the grinding machine and will effect a considerable saving in the actual turning time.

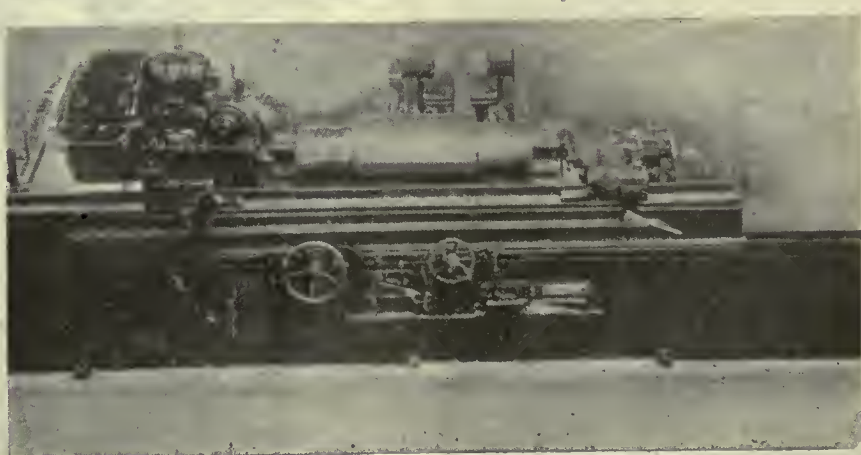
Recent times taken for re-truing tinning rolls average 21 mins. for grinding up a 4½ in. dia. roll 66 in. wide after the tin had been removed by one cut in a lathe taken at ⅛ in. traverse. The roll was in the lathe one-third of the usual time, and users of rolls will appreciate the 21 minutes' grinding time when they compare it with the time taken in their own shops to file up and polish a similar roll. These rolls were ground with a slight camber.

Large grinding machines will grind small as well as large rolls, but where the size of roll is limited a machine suitable for the maximum size should be obtained.

Fig. 1 shows a larger machine grinding a short heavy roll. If a camber is required on this class of roll, it may be obtained by grinding the roll taper from each end towards the centre, leaving a narrow parallel portion in the centre. If a curved camber must be produced the table ways of the machine will have to be specially scraped to give the required curvature, but the request for this must be made before the machine is completed. Rolls up to 6 in. in diameter and not less than 36 in. wide can be ground with a curved camber of .012 in. to .020 in. in the centre of the roll on a standard machine, the camber being obtained by means of the steady rests.

Fig. 2 shows a roll which was ground on a 16 in. by 50 in. Norton grinding machine in one hour. This was of chilled iron, and was ground on the necks or journals as well as on the roll face—the roll face taking 28 minutes of the time; .0625 in. was removed from the diameter, a good finish was obtained, the roll was quite parallel, and the wheel used was a 60K Crystolon.

Fig. 3 is the line drawing of a much more difficult roll—all dimensions were to a limit of .00025 in. including the width of the roll face—the fillets or radii joining the necks to the roll had to be ½ in. radius. The roll was made



4½ IN. ROLL 7 FT. LONG BEING GROUND ON NORTON MOTOR-DRIVEN PLAIN GRINDING MACHINE.

*From "Machine Tool Review."

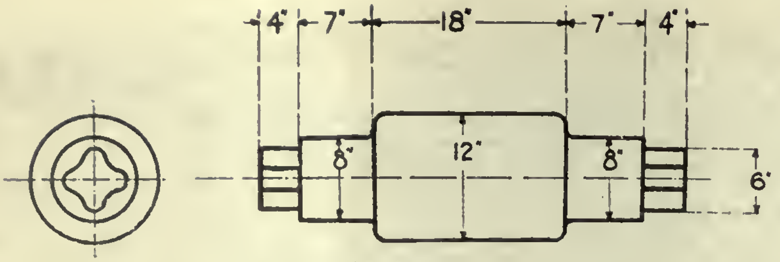


FIG. 2.

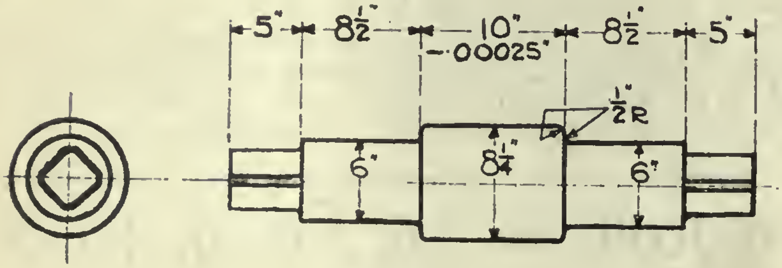


FIG. 3.

of tool steel, bone hardened, having .080 in. to be removed from the diameter. The roll was ground complete on a 16 in. by 50 in. Norton grinding machine in 2½ hours, using a 24 Combination K Alundum wheel.

The time saved by grinding these large rolls is over 50 per cent., and in some cases rolls are now ground up in hours that previously took the same number of days to produce in a lathe.

The following are grinding times on three rolls:—

34-in. dia. by 90-in. chilled iron roll, 3-32-in. removed from dia. in 2 hours 45 minutes.

21-in. dia. by 90-in. chilled iron roll, 1-16-in. removed from dia. in 2 hours.

27-in. dia. by 24-in. chilled iron roll, 1-16-in. removed from dia. in 1 hour 20 minutes.

The following are some comparisons of the times taken to grind a chilled iron roll from the black, and to turn a similar roll in a lathe. When comparing the times we must bear in mind that the roll when it comes from the grinding machine is quite finished and ready for use, whereas the turning times given are for turning only; the rolls must be filed and polished afterwards.

Size of Roll	in Lathe	in Grinding M-c
34-in. by 90-in.	12 hours	7 hours
30-in. " 86-in.	24 "	6 "
21-in. " 90-in.	8	5¼ "
27-in. " 36-in.	5 "	2 "
24-in. " 27-in.	3½ "	1¼ "

Note.—The second roll was especially hard and very difficult to turn.

The re-truing of rolls by grinding has a distinct advantage over turning when the journals of the roll have to be trued. The journal can first be trued up, removing a minimum amount of metal to secure a true surface. After this the roll can then be ground up on the face from its own journals, using journal rests. This ensures the concentricity of the roll with its journals.

Recent research has shown that a protective influence against the rusting of steel is exerted by a copper content that would be described by an analyst as a trace. By increasing the copper content from .01 per cent. to .03 per cent. the corrosion is decreased by 30 to 40 per cent. Steel, with a considerable excess of sulphur, can be protected by a copper percentage of .15.

The total production of radium in the United States up to the close of 1918 has been estimated at approximately 55 grammes, which is understood to be more than half of all the radium the world has produced. From recent survey work it is concluded that the carnotite of Colorado and Utah may yield at least 500 grammes.

It was stated by Professor J. C. McLennan, in an address to the Special Committee of the Canadian House of Commons on Scientific Research, that out of a possible 19 million horse-power obtainable from water power in Canada, 2,305,000 horse-power had already been developed, and it would not be long before a further one million horse-power would be available.

Shells of various calibre have proved by experiments to have considerable commercial possibilities. The steel of which they are made is in many cases capable of being rendered glass hard, and milling cutters have been produced which have stood the most exacting tests. After a little manipulation on a lathe an 18-pounder shell, minus nose and copper rotating band, makes an excellent shafting coupler. The 6 in. shell is readily convertible into a fine flexible coupling.

ANOTHER CASE FOR THE SAFETY FIRST EXPERT.

WELDING AND CUTTING

Welding, Its Relation to Repair Industry*

By L. CEMPBELL, JR.†

THE fusion of metal is usually termed welding. There are four general classifications which might be made of welding in general: the forge; the oxy-acetlylene or other gas processes; the electric arc, and the Thermit method. All these methods are used extensively, and while at first glance they might seem to overlap, in reality, at the present time, each has its own field. To attempt a discussion of all welding methods would require considerable time, consequently we will limit ourselves to the oxy-acetylene process, unless there are questions bearing upon the other questions which may arise.

Acetylene gas, when burned with a proper portion of oxygen gas, produces an extremely hot flame, in fact the hottest flame known. Its temperature is over 6,000 degrees Fahrenheit. With this flame it is possible to bring any of the so-called commercial metals, namely: cast iron, steel, copper, and aluminum, to a molten state and cause a fusion of two pieces of like metals in such a manner that point of fusion will very closely approach the strength of the metal fused. If more metal of like nature is added, the union is made even stronger than the original. This method is called oxy-acetylene welding and differs from what the average layman considers welding in the blacksmith's forge, in so much that there is no blow struck to assist fusion in this process. And while the forge method is limited to wrought iron and steel which is detachable and of restricted size and shape, the oxy-acetylene process has, practically speaking, no such limitations.

As a manufacturing process a wide field opens up, but as we are limited in our discussion to the repair industry, we will merely hesitate to mention that on the Liberty motors, with which you are all undoubtedly familiar, there were 87 feet of welding, most of which was fusing cast iron to steel. As a repairing agent, the welding torch has no rival. Whether it is a casting iron, steel, brass, or aluminum that has broken; a boiler or tank that has worn away in spots, or an error on the part of engineer, foundryman or machinist, the part can generally be reclaimed and made stronger than originally. To-day practically no manufacturing concern that is dependent upon metallic machinery could think of being deprived of its oxy-acetylene apparatus, once having learned its worth. In the not far distant past, were a gear or some casting to break, it probably meant closing down the entire plant until a new part could be obtained, which, whether the source of supply was near or at a long distance, would mean costly delay. With oxy-acetylene equipment and an efficient operator on hand, almost every emergency is provided for.

If an automobile owner breaks a frame, he does not consider replacing it with a new one, as the labor alone for stripping his machine and setting it up again, not to mention the cost of the new frame and the time required for this operation, is prohibitive. Rather, he has his car taken to the nearest welder or his portable apparatus to the car and the job is completed within thirty or forty minutes, with the frame at the point of the break made stronger than ever. Locomotive frames are handled in much the same manner, only more time is required and perhaps extra operators, but the important point to be brought out is the fact that on many jobs no dismantling is required and the repair is permanently and quickly executed.

For service in the field on tractors, trucks and other automotive machinery a large percentage of the trouble is occasioned by the loosening of rivets which permits undue strains upon the transmission, the motor and other working parts. The welding torch permits a concentrated flame being played upon the loose rivets and a hot riveted joint being made. For brazing, pouring bearings, straightening bent members, welding water jackets of motors that have been frozen and many other parts too numerous to mention, the welding torch plays a very important part.

For salvaging, from the experimental laboratory right down through the entire factory, the welding arch eliminates costly delays. If a casting has been improperly designed and falls short of certain measurements additional metal may be added, lugs built up, and many other parts, which eliminates new patterns being made and the time lost while awaiting for new castings. In the factory, machinists' errors may be corrected, for if holes are drilled in the wrong place they may be filled up and drilled correctly. Broken taps and drills can be quickly removed, and many other applications found by the wide-awake engineer.

Why then, since every emergency is practically provided for, should replacement parts be kept on hand? Lack of efficient operators, is the answer. In turn, we ask why should good operators be lacking? This trouble is due, no doubt, because no means has been provided for the education of welders, and the inability to test a piece that has been welded.

It is surprising to learn how many good men have condemned the entire oxy-acetylene welding process, simply because some careless operators have turned out very poor pieces of work. Perhaps, righteously so, from their standpoint, but we do not think we are overstepping our bounds in estimating that 75 per cent. of those who claim to be welders are truly nothing more or less than "plasterers" who add metal without any thought of fusing.

How can welds be tested? Directly we are aware of no general rule for testing each particular weld, but this fact should not prevent our learning the skill of the operator. It is quite a simple matter to provide a welder with test bars of the metal generally worked, and have him fuse these bars from one side only. As soon as cold, they can be sawed through the weld and an etching acid applied, or a more simple method is to break the bar through the weld and on an anvil, and inspect the fracture. If a good clean break presents itself and the crystals are uniform, it is reasonable to suppose that this operator knows how to fuse that metal and can be trusted to make similar welds. It is appalling to learn how few are concerned enough with the skill of their operators to test their results. If more care were exercised along these lines, both the welders themselves and the overseers would benefit the industry as a whole.

The oxy-acetylene process of welding presents a very valuable means of making repairs and general salvaging, but in

*Read before Society of Automotive Engineers, Minneapolis.

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order to obtain the greatest efficiency it is absolutely essential that the operator be educated, first, to know his tools; second, to be able to distinguish one metal from the other; third, to be able to fuse thoroughly the metals he is called upon to weld, and, fourth, a general knowledge of contraction and expansion of metals where heat is applied.

Welding, Its Relation to Repair Industry

Welding apparatus in general consists of two regulators equipped with pressure gauges, two lengths of hose, and a welding torch. The regulators are attached to cylinders of acetylene and oxygen and are used to reduce and maintain a uniform pressure of these gases for use at the torch. The gases at reduced pressure are conveyed to the high-pressure gauge to indicate the contents of the cylinder, and also a line of working-pressure gauge to show the gas pressure on each hose. When the gases reach the torch they are there mixed and combustion takes place at the welding tip, which is fited to the torch. Such an apparatus is called portable, on account of its movability. There are other equipments wherein one or both of the gases are generated, but these will not be discussed here.

There are many small apertures in both the welding torch and the regulators which are required to be kept perfectly clean. The regulators, especially, have many sensitive parts which are constantly subject to much abuse. On the oxygen regulator, a pressure of 2,000 lbs. when suddenly opened against a small seat causes considerable trouble unless all passageways are kept clean. When the cylinders containing gas have been left out in the rain or storm, it is not an uncommon thing to find dust or rust accumulated in the cylinder valve. This should be all blown out before the regulator is attached to the cylinder, to prevent this foreign matter being carried into the regulator. But there are very few operators, indeed, who observe this practice. To thoroughly appreciate and treat the welding apparatus with respect, it is quite necessary that the welder become acquainted with the tools he works with, so he can make them function properly and real efficiency can be expected.

In the past "flash-backs" were not an uncommon thing, and they caused much loss of time, gas, and inferior welds, but they are now a thing of the past with modern apparatus. We have found that "flash-backs" are caused by an improper mixture of the gases, which increases the rate of flame propagation to such an extent that the flame will flash back to the mixing chamber. Acetylene in a pure state will burn very much slower than when mixed with equal parts of oxygen. When more oxygen is introduced the flame propagation is much greater, so that when an excess of oxygen is used, there is bound to be considerable trouble from backflashing. When sufficient acetylene is introduced to the mixing chamber, there is absolutely no chance for this lean mixture to occur. If the flame flashes back to the mixing chamber, both gases should be closed off immediately, at the torch, the oxygen first, and then the acetylene gas.

In some torches the heating of the mixing chamber will cause a flash-back and with these it is necessary to shut off the acetylene and leave the oxygen valve just cracked and immerse the torch head in water, dipping it slowly, so as not to cause too great a strain. The oxygen will bubble out and prevent the water backing up in the tip. If the flash-back deposits enough soot on the inside of the tip and the head to impair the working quality of the torch, the soot should be removed by using a soft wire, preferably of copper, or some other material which will not mar the tip.

In order to know how to weld, it is quite imperative that the operator first know the kind of metal he is to work on. It is surprising to find how few welders know their metals thoroughly.

The Difference in Metals

There are many operators who have trouble in distinguishing such metals as cast iron from malleable iron and cast steel and as each of these metals require a different "filler rod" it is quite necessary that their nature be determined before hand. An incident might be cited where some welders depend upon the sparks given off by the emery wheel in determining the kind of metal they are about to weld. They will approach the wheel; grind off their work, noting the sparks; return to their welding table; choose their filler-rods and do their welding without any delay whatsoever, much to the consternation of their fellow workers. There are four simple ways in common use to distinguish between cast iron malleable iron, cast iron and steel; they are: By casting the cross-section of a fresh break, by application of the welding torch, by the sparks given off when applied to the emery wheel and by the chisel test.

Externally cast iron usually has some sand on its surface and its cross-section shows the grain to be fine, even, and to have a dull grayish color. The surface of malleable iron contains no sand and its grain is very fine, such as cast iron, but slightly darker in color. A very fine steel veneer is on all surfaces of malleable iron, which is much lighter in color. When the welding torch is applied to malleable iron a bright spark is thrown off which breaks in falling, showing that the outside material is steel. Those sparks soon cease and the metal which is molten is covered by a heavy oxide or skin which recedes or draws away from the flame slightly, showing a very porous castiron interior. When brought in contact with the emery wheel steel sparks, which are very luminous and break in falling, are given off first in the case of malleable iron, but they soon change to the dull red spark of cast iron. When a chisel is applied to cast iron, the iron chips off; when applied to malleable irons the edge will curl up, then chip off when the cast iron is reached. The cross-section of cast steel shows a bright, coarse, silvery gray grain. When the torch is applied a distinctively steel spark, which is luminous and breaks in falling, is thrown off. When applied to the emery wheel steel sparks are thrown off; when the edge is chipped by a chisel it will curl up.

The metal in the filler-rod should be the same in practically all cases as the metal to be welded. There are few exceptions to this rule, but the principal one is that of malleable iron. The cast iron in the rods is of a very good grade and generally much better than the piece to be worked upon. To permit the ready flow of the rod and eliminate oxidation, as much as possible, three per cent. of silica is used on the casting of filler-rods for cast iron welding. Piston rings and other scrap iron should not be used for filler-rods, as they contain many impurities such as core-sand, dirt, grease, etc., which will ruin the weld. It is disheartening to see some operator attempt to economize on the filler-rod. It is not an uncommon sight to see several dollars' worth of gas and the same amount of the welder's time. together with a few cents' worth of filler rods all lost, and the operator's reputation ruined. This because an attempt is made to save the few cents involved in the filler-rods by substituting a rod of a very poor grade.

A flux is not used, as many suppose, to cement the filler-rod to the metal. It is used purely as a cleaning agent and may be likened to the acid used in soldering. It does not act on the metal until the latter has reached the melting-point, but then it starts to break up the oxides and clean the surface. This action permits the metal to flow together more readily. A cast iron flux is always used in welding cast iron, to break up the oxide, because the cast iron itself will melt before the oxide and no matter how hot the metal is it will not flow together as long as this oxide is present.

To obtain the best results, reliable fluxes should always be used. The flux is generally applied by means of the filler-rod. One end is heated and dipped in the flux; enough will adhere to break up part of the oxides, on the ordinary-sized job. The flux is carried to the work, which should be at the melting-point and introduced between the flame and the metal. Oxides will break up immediately and the metal will flow together, but it must be remembered that the flux has no action on cold or moderately heated metals. The flux, as has been explained, is used to clean the metal and break up the oxides. To the oft-repeated question, how often should the flux be applied, answer is made as follows: As often as it is necessary to clean up the metal and break up the oxides. All fluxes should be kept in air-tight containers when not in use, to keep their chemical contents in the very best condition and it is best to use only a small quantity of flux on the welding table at one time.

As we stated before, oxy-acetylene welding is purely a fusing process and the most important points to remember in executing a weld are to eliminate the entire crack in the fracture and to add the filler-rod without changing the character of the metal. On thin pieces of metal it is possible to depend upon the force of the flame to entirely penetrate to the depth of the crack, but on work three-eighths of an inch thick or over, it is well to "V" out or remove some of the surface metal around the crack in order to get down to the bottom. By "V-ing" we mean to chip or grind off each edge at an angle of approximately 45 degrees, so that the opening will form an angle of 90 degrees where the two pieces come together, with the crack at the bottom portion of the "V." This should not be ground down to a knife edge, for it will readily burn up. It is preferable to leave about one-eighth inch along the line in order that the pieces will fit together and the proper alignment may be obtained. If two pieces of cast iron have been prepared in this manner the neutral flame of the welding torch is brought down in such a manner that the tip of the cone just licks the metal. The heat is not applied directly to the line of weld to start with, but rather to the surrounding part. This is done in order to get the entire locality in a condition which will not withdraw too much of the heat from the line of the weld, once the fusing is begun. If it is found that the tip will not produce enough heat to bring the metal to a red heat in a fairly short time, a larger tip should be used.

No Rule Possible

No set rule can be given as to the sized tip to be used on various kinds of metal. It will largely depend upon the welder's ability and judgment. When the metal is brought to red-heat, the neutral flame or cone is brought into contact with the lowest portion of the "V" and held there until it is seen that the metal is melted on both sides. The filler-rod, which has previously been heated at one end and dipped into the flux so that an amount adheres to the end of the rod, then carries this flux to that portion of the weld which is under way. Enough flux is blown off the rod into the weld to clean up the surface and permit the metal flowing together. The crack should be melted together all along before any additional metal is added, for the elimination of the crack is extremely important. It might be noted that as soon as the metal begins to flow freely the neutral flame should be raised a short distance from the work in order to better control the molten metal. In order to build up the metal to the original state along the line of weld or perhaps reinforce it, the sides and bottom of this "V-ed" out part are then brought to a molten state and held there while the filler-rod which brings up more flux is stirred into this metal and the end melted off. In this way the flame does not come in direct contact with the filler-rod and is used only to keep the metal in a molten condition. As much of the filler-rod can be melted off as is thought necessary to bring the weld to the normal condition of the metal or an additional reinforcement can be built up, if it is thought advisable. If care is taken in the above procedure, many of the blow holes and hard spots in the weld will be eliminated, for any impurities that might gather will be displaced by the melted metal and will float to the top. In cooling a weld of this kind, care should be taken not to permit any sudden chilling, for this will tend to harden the weld. It is best to cool it slowly by burying it in slack lime, ashes, or wrap it with asbestos paper to keep the air from it as much as possible.

There may be a great many causes for blow holes and hard spots in the weld, but probably they can all be traced directly to the lack of heat. It must be remembered that welding is a fusing process and heat is absolutely essential. Therefore, it should not be used sparingly. Welders who would not think of throwing a cast iron weld into cold water for fear of chilling the metal can be found lining up their work on large metal slabs or face plates and making the weld in this position. The large body of metal conducts the heat away from the weld and cools it very rapidly, causing it to be chilled, and there is no wonder why the weld is hard and brittle if this method is used.

The application of heat always caused expansion. There are no exceptions to this rule, likewise upon cooling the metal there will be a contraction. Outside of the actual welding, that is, the fusing of the metal into a homogeneous mass, perhaps the greatest problem that the welder has to confront is the expansion and contraction of his metals. Whenever the ends of two pieces of metal which are to be welded are free to move, or even one end, there will be no difficulty encountered with contraction and expansion, but if those ends are continued, it is an entirely different problem. In the latter instance, preheating is necessary to reduce the expansion to a minimum when the welding flame is applied. Whether the entire piece is to be preheated, or only one number, depends largely upon the nature of the work.

In the case of repairs the matter of costs plays a very important part. Many times the cost is a very small matter, but in other instances may exceed the cost of a replacement part. But if no part is available it may be worth while to weld it. In computing costs, conditions will naturally vary in different shops. In some cases where the parts are heavy they will be preheated and naturally will require less gas and time to weld them if they had not been so created. The time of the welder, the amount of gas and material used, added to the overhead, forms a basis for figuring costs. The amount of gas used on each job where individual cylinders are used can be determined from the gauge on the oxygen regulator, if a chart is obtained from the manufacturers of the apparatus showing the ratio of the oxygen consumption to that of the acetylene. This ratio varies for apparatus of different types.

In acetylene cylinders an absorbent called acetone is generally used, which gives up the gas as required. A full cylinder can be used for some time without any noticeable difference in the gauge reading, and then as it nears the empty point the gauge reading will drop very perceptibly. It is therefore impossible to depend upon a high-pressure acetylene gauge as an index to the contents of the cylinder. The only method known to correctly check the amount of acetylene gas on hand is to weigh the cylinder. There are 14½ cubic feet of acetylene gas to the pound, and when the net weight of the cylinder is given the contents can readily bo figured. A tag bearing the net weight or figures which will permit this computation is generally found attached to each acetylene cylinder. In the case of oxygen cylinders, there being no absorbent used, the contents of the cylinder is indicated on the high-pressure gauge. On the latest type gauge the contents will be shown by cubic feet, by pounds pressure and by atmospheric pressure, to facilitate the computation of costs by the operator.

It may appear strange that so much emphasis has been made upon "fusion" in this talk on repairing, but really this is the keynote for successful welding, and without it, permanent repairs cannot be anticipated. The method of testing the operator's skill which we have referred to is quite a simple matter, yet one which is overlooked and has been the cause of much careless and ignorant applications in the oxy-acetylene industry. During the world's war we were called upon by the Ordnance Department of the army to establish schools and train welders for the various departments of the service. During this time, approximately 2,000 men were trained, averaging about 20 test welds per student.

In personally inspecting these 40,000 odd test welds a very good idea was obtained as to the ability of the operators who composed the classes, many of whom were men who had had considerable experience in civilian life. It is with this condition still in mind that we are trying so hard to emphasize the importance of through fusion. With proper training the results are most gratifying and it certainly behooves those dealing with, and depending upon, machinery and metal parts to-day, to give due time and consideration to the oxy-acetylene welding process and the operators who are called upon to do the work.

DEVELOPMENTS IN SHOP EQUIPMENT

THE MULTI-GRADUATED PRECISION GRINDER

The Precision & Thread Grinder Manufacturing Company, 1932 Arch Street, Philadelphia, Pa., are demonstrating improved grinding equipments, comprising several attachments, which can be used in conunction with any machine tool capable of use on a variety of work, and particularly adapted for thread grinding on lathes.

The grinder attachment, as shown in illustration, is a right-handed attachment for use in front of the lathe centre.

A noticeable improvement is the new style wheel truing arm, which is now attached to the base of the grinder in such wise that the thread angle is dressed on the wheel on a plane with the axis of the work centres, this producing a perfect formed thread. It also has positioning pins for quickly locating the angles for "V," U. S. and Whitworth threads.

This concern also makes a similar machine which is identical in all respects with the one exception that they face in opposite direction.

The grinding spindle is carried in five precision ball bearings, adjustable for radial wear and end thrust play, and are protected from abrasive dust by felt-lined steel bushings. The spindle housing carrying these also has an oil reservoir, and the bearings are always in perfect lubrication.

This style of spindle bearing precludes the possibility of the spindle being brought out of original alignment by taking up adjustments, as in the case of solid bearings. It is guaranteed that no heating and expansion of the spindle lengthwise will result.

The base and the spindle housing are proportionately massive and of solid construction to absorb vibration and eliminate chatter marks from the finished surface.

The spindle housing fulcrums in a vertical traverse plate and is indexed with graduations for setting to any angular inclination to conform to the helix angle of the thread.

Means are provided for raising and lowering the traverse plate to bring the wheel centre into alignment with the work centre. The spindle housing is provided with a longitudinal feed traverse, for bringing the wheel into lead with the thread, and also to shift the cut of the wheel during the grinding operation in cases of irregular distortion, in order to clean up the surfaces in all cases, without the need of leaving a lot of oversize stock on for grinding.

The wheel truing arm, which carries the truing device, is provided with vertical graduations corresponding to the angular graduations which facilitates the setting on of the wheel truing arm to always bring the diamond into correct centre into the wheel. The arm is instantly detachable after truing the wheel, by means of a breech lock screw. The truing device has a graduated base for obtaining any angular setting, in addition to the locating pins before mentioned.

The machine is equipped with individual motors of any specified voltage, and either direct or alternating current, sufficiently powerful for heavy duty work. This arrangement permits of always having the proper speed for the wheels. The motors are balanced to preclude vibration.

An outstanding new feature is the power transmission system, which is accomplished by an endless belt, which has a three-point contact with both the driving and driven pulleys and then travels over a compensating two-pulley arrangement, which automatically keeps it at the proper tension to prevent slippage and at the same time slack enough to prevent loss of power and heating.

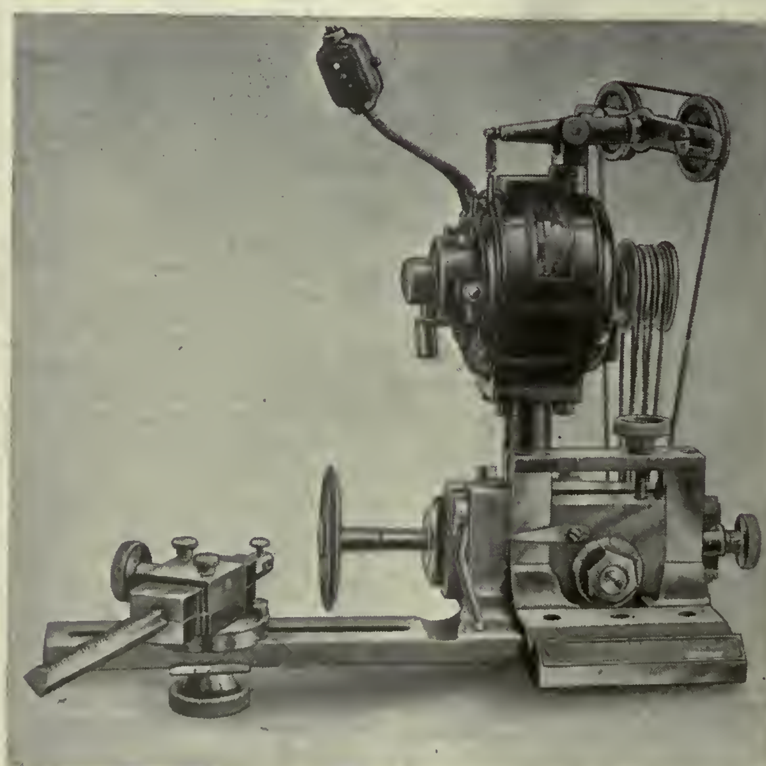
The capacity of the machine is limited only by the size of the lathe it is attached.

The regular equipment includes a full assortment of wheels, diamond, motor, chart showing angular setting of various pitches and diameters, and wheel adaptors.

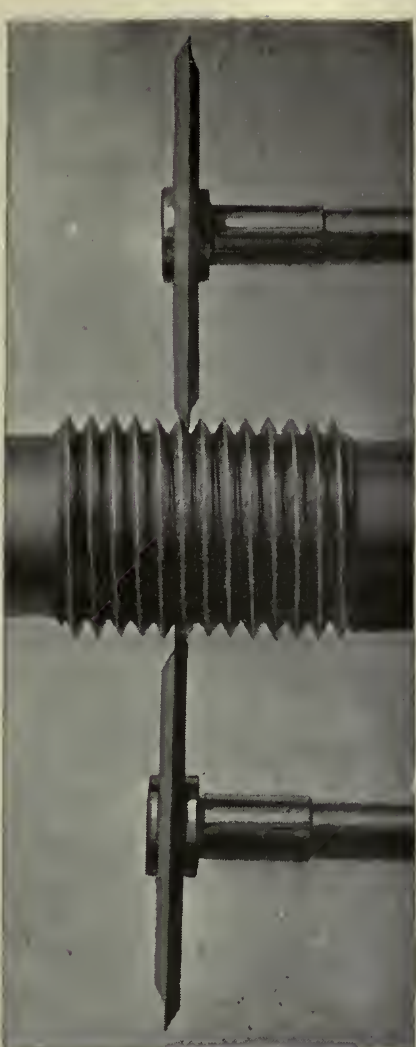
Duplex Thread Grinder

This arrangement has been originated to meet the need of production grinding of screw thread surfaces on a commercial basis—such as taps, chasers, thread moulds, and rolling dies for threads, and a great saving results where duplicate sets of thread gauges are required.

By this arrangement a large lot of duplicate pieces may be rapidly ground, as after the setting of the wheels on the first piece of the lot, the setting of the wheels is not disturbed thereafter, but the following parts are brought into lead



GENERAL VIEW OF GRINDER.



SHOWING WHEELS GRINDING THREAD.

with the wheels by means of an adjustable rotating lathe dog.

The wheels are beveled on one side only as shown in Fig. 2. Each wheel grinds only on one side of the thread angle and on the root of the thread. Also each wheel grinds on an opposite side of the angle to the other wheel. Both wheels grind on the root of the thread simultaneously. This is especially valuable in getting the sharp bottom in a "V" form of thread, there being no included angle point to wear away. The wheels do not require redressing, the effect being the same as flat grinding with a straight wheel.

A very important advantage is that very heavy cuts may be taken, without resultant heat of friction, as is the case in grinding included angles. The fact of one side of the wheel being free and without bearing surface against the part allows the wheel on very heavy cuts across irregular or distorted surfaces to maintain the correct angle on its beveled and working side, for in case there is too much distortion to remove in the first cut, the wheel is made with sufficient elasticity to slightly spring toward the free side. There being less cause for this spring on each subsequent cut across the thread, the high, distorted and untrue surfaces are soon brought down, without the wheel losing its correct angle on the bevelled side.

This arrangement requires the use of both type machines in combination.

TOOTH ADJUSTMENT FOR INSERTED TOOTH SAW BLADES

A new arrangement for adjusting the teeth of their inserted tooth saw blades to the proper distance from the centre of the blade has been developed by the Hunter Saw & Machine Company, Pittsburgh, Penna.

The high speed steel teeth are supported by hex head heat treated steel screws (see illustration) and half round removable steel nuts embedded in the body of the saw blade. A milled tongue in the semi-circular nut pocket fitting into a groove in the nut holds the nut firmly in place and prevents any side movement. A clearance hole drilled into the body of the saw blade at the bottom of the nut pocket just large enough for the screw, serves as a receptacle for that portion of the screw projecting through the nut when the tooth is set in its lowest position.

The arrangement permits the adjustment of one or more teeth independently of the others. As all teeth will not wear alike, it may become necessary at times to remove one or more teeth for regrinding, or a particle may break from the cutting point of the tooth, making regrinding or replacement necessary. In either case, the tooth must be readjusted to its proper relative position with the other teeth.

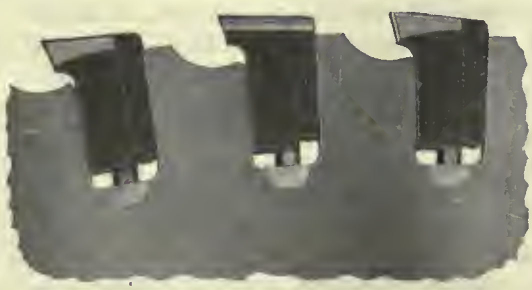
The screws and nuts are easily removed or replaced if either should become damaged or worn through service.

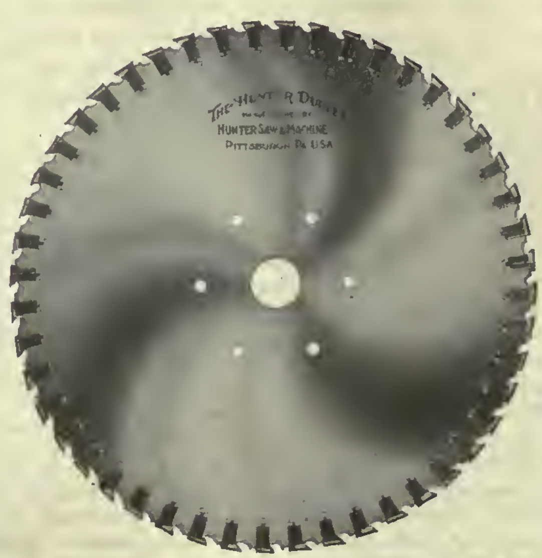
After setting to the proper height, the tooth is securely clamped in position by a grooved hardened steel wedge or key.

The exclusive sales rights in Canada of the Rego welding and cutting outfit and supplies manufactured by the Blastian & Blessing Co., Chicago, have been acquired by the Carter Welding Co., Toronto. The latter company will operate sales and service stations in the cities of Hamilton, Montreal, St. John, N.B., Vancouver, Calgary and Winnipeg, with headquarters in Toronto. Before taking over the rights of the Rego welding outfit the Carter Welding Compnay were sales agents in Canada for the Davis Bournonville line of welding and cutting apparatus.

FIRE NOT SERIOUS

The Latrobe Electric Steel Co. had a slight fire at their plant that has been greatly exaggerated in the Pittsburgh papers. The fire was confined to the heat treating department, which was damaged to the extent of about $8,000. This department was not essential to the regular production, and will not interfere with the regular schedule of filling orders. None of the employees will be thrown out of employment.





THE SAW, AND A DETAILED VIEW OF THE TOOTH ADJUSTMENT.

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PRINCIPAL CONTENTS

Being Fair To Them All

THE MOULDERS' UNION of Brantford, in a recent meeting, passed a resolution protesting against the policy of the Brantford *Expositor* in refusing to insert advertising matter in its columns telling of vacancies in other places. The moulders claimed that wages were higher in other places than were being paid in Brantford, and that by refusing to publish these advertisements the paper was discriminating against the Brantford workers.

There is nothing particularly new in this case. The real motive behind the action of a paper in such a case is that it does not want to place the local manufacturers at a disadvantage. It believes, and rightly so, that its own city is as good as any on the map, and that if wages are a little higher elsewhere, living expenses will keep pace. In this latter assumption the paper is also correct.

When the labor market is scanned just now it would appear that taking men from one city to another is simply taking worries and troubles from one shop to another. A number of firms that never turn out apprentices are always very willing to grab off all the finished men any other factory may turn out.

Although there is much to be said on both sides of the question, any paper is within its rights in refusing to accept advertising that it considers will harm the best interests of the community. We doubt very much if any mechanic can better his position very much just now under present conditions by moving from one place to another unless he has a promotion in sight.

At other times such a policy on the part of a paper would be wrong. There might be work in one place and not in another. In such conditions, the paper would be doing the men an injustice by keeping this information out of print.

Doctoring Our Lignite

CANADA has had enough coal experience in the past two or three years to make the nation stop and think. The trouble with these stopping and thinking seasons is that they are brief and evaporative.

When we are up against the real thing we stop and think and promise.

When the real thing has been removed, we at once forget about the stop-think-and-promise session.

That is what happens to the average Canadian in regard to the coal supply of this country. As soon as he gets a supply, or as soon as his fire is out for the summer, he proceeds to forget it.

The industrial section of Canada is more apt to remember the problem, and for this reason should appreciate the work that is being undertaken by the Lignite Utilization Board of Canada. Industrial sections are interested in domestic fuel as well as in power and heating provision. If the employees can get only a little coal, and pay a very high price, they are going to be dissatisfied and the firm employing them suffers.

The Lignite Board for the present is chiefly concerned with the deposits of lignite in Saskatchewan and Alberta, although Saskatchewan would be the more strategic point from which to work, either east or west. The order creating the board says in part:

"That by carbonizing this lignite, a coke or charcoal is obtained which briquettes readily and, without consideration of the by-products such as oil, pitch, ammonia sulphate, gas, etc., the result is to turn two tons of inferior fuel into one ton of briquettes approximating, in heating value, anthracite coal with practically the same heating value in the domestic furnace as the two tons from which it was made."

A study of machinery, processes, etc., for briquetting this coal is being made, and the matter of using any other by-products will be considered.

Western Canada has heretofore imported about 500,000 tons of anthracite from Pennsylvania at a cost of about $5,000,000 per annum.

Canada's coal resources are greater than those of any country in the world, with the exception of the United States. Much of Canada's coal, however, requires treatment before being available for satisfactory domestic use.

It is expected that a successful outcome of the development undertaken by the board will result in the establishment of an industry of national importance.

Where is the Weakness ?

IT IS a widely known fact that some manufactured products cannot be obtained outside of a particular locality, of the same degree of excellence as in that favored spot.

Various reasons are given for this variation of quality, ranging from the difference of climate to the lack of skill of the operators. It is notable that even with the same appliances and the same men, certain woollens cannot be manufactured on this continent as they are in England or Scotland. The same is true of certain brands of mineral waters, and very true of that much discussed fluid, beer.

However, one would think that such a thing as cast iron would not be affected by little delicacies of manipulation or environment. Chemists can tell us just what properties a certain proportion of the various pig irons will possess when melted together and poured in a casting. Take marine engine cylinders, for instance. The quality required is hard, close-grained iron. The experience of generations of cylinder makers is available. Stationary cylinders have been produced in Canada for years. When the necessity arose to make marine cylinders considerable trouble was encountered, and it is a fairly well known fact that the cylinders which were made and delivered have suffered from certain weaknesses, which have involved costly repairs and replacements. Just across the line they seem to avoid these difficulties. Where is the secret? Can any of our founders explain this question?

HE FOUND THE GARAGE BUSINESS ALL RIGHT

Thinks the Public Have Confidence in Bringing Business to the Machine Shop for Attention

WHY SHOULD the machine shop, especially in the smaller cities and towns, get a larger share of the automobile repair business? It requires only a little thinking to see that this is a good line, and one that is growing. A new lot of people are buying cars every year. They know little or nothing about the mechanical details of the car. They know how to start the engine, stop it and steer the car. When anything goes wrong they may figure away at the instruction book, but as a general thing it will be found that many of them want to buy some real mechanical service.

The garage men have picked off most of this business, but why should not the machine shops, equipped for the purpose, keep things coming their way? The standard of the work done in the average garage, from the mechanical standpoint, is poor.

CANADIAN MACHINERY discussed the matter with the proprietor of a machine shop in a town of about 6,000 in Ontario, and found that this man had found a good line of business in the automobile. Here is part of his experience:

"When cars started to become quite common in our town the business of repairing them was attended to by the local garage, and afterward by the garages, as they increased. Where there was any work required of a fine nature, or where good mechanical sense had to be used, they brought it over to me, and I charged my usual rates for the work. A little inquiry showed that the price charged to the car owner was about double what I was charging the garage men. I talked the matter over with a couple of men in the shop, both of whom were good mechanics, and we decided that it would be good business to go ahead and make a bid for this work direct.

"Well, we took a part of the shop that opened right out on the street, but which had been used for storage and junk in general. This was cleared out, and a big double door put in. The thing was planned so that the car being repaired would be right next the machine shop. We got this ready and obtained a list of all the automobile owners in the town and country. Our announcements were sent to all these people, and a couple of weeks later we followed this with another letter, at the same time doing some advertising in the town paper. We made it a point to state that an automobile engine, the transmission, ignition, etc., was a fine and well-adjusted piece of mechanism, and should, when in need of repair, be entrusted to men who had made a life study of the mechanical field.

"It wasn't over three weeks before we were approached with the idea of taking the agency for a car that had not been introduced very well in that district. Of course this did not seem to fit in with the work of running a machine shop and foundry, but we went ahead. I put one of my own men in charge of the agency, and stocked a lot of supplies. I am not going to give you any figures as to what we are doing between machine shop, foundry, garage and agency, but I sometimes wonder which of these friends is the best to me. They are all busy, and they all make money for us. You can pass this along to others who may be in similar positions. They will find what we found, that the general public has confidence in the machine shop to undertake the making of repairs on their cars. There is a feeling that the machine shop ought to know, and the machine shop ought to know enough to capitalize on this. The garage business is good now, and it lines up with what a mechanic knows. "Look into it" is my advice."

The Smallest Screw Made

DURING wartime we heard much of working to fine dimensions. People who used to romp around the shop with a foot rule and measure eighth-inches only in a pinch began to think and measure in terms of thousandths.

A writer in a current magazine speaks of the smallest screw used in the smallest watch made in this country.

Now put down your monkey wrench, screwdriver, hammer and can opener, step over and hear what is said about this screw:

It might be possible, under some conditions, to hear the proverbial pin drop, but no ear could catch the sound of the dropping of one of these screws.

The screw can be definitely seen only with the imagination or a watchmaker's glass. This tiny screw is of brass, of the following dimensions:

Total length, 28 thousandths of an inch.
Diameter of head, 26 thousandths of an inch.
Diameter of the thread, 12 thousandths of an inch.
Number of threads per inch, 360.
Weight, 12 thousandths of a grain.
It takes 583,333 of the screws to make a pound.

The machines for producing these screws are different in design from any other screw machine that is known of. They are of a positive cam action type and have proved very satisfactory to their users.

There is but one chuck to a machine of this type and a single piece of stock is used. These machines are so accurately made and the parts so closely fitted together that it is necessary for them to be warmed up in order that the oil may work in all of the bearings before they start to produce. Otherwise they would not operate.

The machine is belt-driven. Compressed air is used on these machines for the purpose of forcing oil to the different parts of the machine and also to blow out the finished work after it has been cut off. These machines are electrically controlled and are so arranged that they stop whenever the stock is used up or the finished screw not blown out of the machine.

MEN will continue to demand more wages as long as prices continue to increase. Tacking on more to the prices of things men must buy to support their families is one sure and certain way of trumpeting to them to formulate new wage demands.

The Vacant Chair

MARKET DEVELOPMENTS

Big Volume of Business in Many Lines Now

Some of the Makers Are Facing Peculiar Situations Trying to Keep Up With Supplies at Prices They Have Named to Their Distributors. Prices Continue at Very High Level

KEEPING up with the prices is providing a merry time for a good many lines of business in either steel, iron or machinery. There is a much larger volume of trade moving now than a year ago in many of these lines, and this is bringing new problems never encountered before. Here is a case in point: A large Toronto distributor has been in the habit of sending about $4,000 a month in business to a certain maker of pulleys. This year there has been an enormous demand for this line of equipment, and business has been going forward at the rate of something nearer $20,000 per month. The maker of the pulleys had based his 1920 business on the 1919 and allowed for a very slight increase. His contracts for material were placed accordingly. Now that he has to go into the markets again over and above his contracted amounts he comes into contact with new peak prices, and on these he cannot produce to sell at a price named by the distributors who have sent him the business. There are several cases of this. It is the result of firms trying to be careful in their purchases of material in a season when it is very hard to be careful and busy at the same time.

Supplies are moving out very rapidly, with prices firm. Nothing better can be said for the supply of steel and iron coming to this country. Much of the steel is from the premium mills and brokers, and of course the price is fairly high.

Several dealers from this district have been in the United States machine tool districts during the past few days. From reports there they can see nothing much better in sight in the way of deliveries or lowered prices. There are several lines that are now selling at from 18 to 20 per cent. above the high prices that were asked during the war, and yet the state of trade is good enough to make it a fact that delivery and not price is still the deciding factor in the business.

The scrap metal market continues uninteresting. There is very little business moving.

OPENING OF SHIPPING IS EXPECTED TO MAKE DIFFERENCE

Special to CANADIAN MACHINERY.

MONTREAL, Que., April 8.—With the gradual clearing away of winter conditions that have generally interfered with the transportation problems of the railroads, the prospects for betterment of trade are more encouraging.

Dealers here are more hopeful regarding the early improvement in delivery of materials. Circumstances are shaping toward the point when operations throughout the industrial world will take on a more normal note and where trading will be carried on with less uncertainty than has been experienced during the past six months. It is anticipated that the opening of navigation, which is generally looked for in a couple of weeks, will provide some relief to shipping, so that railroads will be in a better position to adjust the car conditions, the chief factor that prevents a speedy return to normal operations. Reports coming from the States indicate that production in the steel district is steadily increasing and that freer shipments of fuel and raw materials will enable the mills to operate to better advantage from now on. While there appears to be no marked shortage in any one particular line in this district, the difficulty experienced by many consumers in getting material prevents them from carrying out some undertakings that would be attended to if more supplies were forthcoming. Shippers here have been studying the new wharfage rates effective this season, and several meetings have been held with the Harbor Board in an effort to have a revision made in the charges on different commodities. Plate and sheet users are still experiencing some difficulty in getting supplies but are generally able to secure sufficient to maintain normal operations.

Copper Demand Improves

A general rally has apparently developed in the metal market and a relatively strong situation has arisen out of the comparatively dull condition of a week ago. Local demand has shown a slight increase and inquiry indicates a good market during the present month. Copper is moving freely and has regained the strength of a few weeks ago, the past week or so being marked with a dullness that tended to lower prices. Tin has been weak but advances in English markets have prevented a decline in prices here. Other metals are not active, the demand being normal and the prices firm.

Steady Improvement Shown

Business in machine tools has become more settled as a result of the improved exchange conditions, but dealers and users are still experiencing difficulty in getting desired delivery of equipment, particularly where such is wanted promptly. Manufacturers are promising improvement in this regard, as they state that the near future will see relief in many ways. With the winter difficulties passing away and the return of inland water transportation only a question of a few weeks, the pressure on the railroads will be partially removed, and movement of materials proportionately increased. The demand for small lots of machine tools is steady in character and while new tools are largely wanted, the sales of second-hands show little decline over the past few weeks, which were quite extensive. A feature of the present supply market is the increasing quantity of English made goods that many dealers and agents are offering.

It is believed that many British houses are recognizing the advantage of stocking their lines here as consumers are reluctant to depend on delivery dates, even though dealers promise better conditions than exist on some lines from the States.

Scarcity in Steel Scrap

There is still a heavy demand for steel scraps and machine cast iron, and there is little of either to be had. Mills are endeavoring to obtain supplies but dealers are unable to fill the full requirements of many consumers. The nonferrous market is more normal and the movement is quite regular, but prices are very firm and less subject to change than that of steel or iron scraps, where the irregular supply makes it difficult to quote definite prices.

New Incorporations.—The following companies have been incorporated in Ottawa during the past week: J. Coughlan & Sons, Ltd., shipbuilders, Vancouver, $3,000,000; Max Beauvais, Ltd., tailors and haberdashers, Montreal, $500,000; Wilson, Paterson and Clifford, Ltd., merchants, Montreal, $1,000,000; Dauphin-Earle Co., Toronto, $250,000; United Farmers' Guide, Ltd., Winnipeg, $250,000; Black Star Line of Canada, Ltd., Montreal, $1,000,000; Rite-Bake System Bakeries, Ltd., Toronto, $50,000; Inter-Provincial Clay Products, Ltd., (not stated) $500,000; Trans-Canada Sales and Storage, Ltd. (not stated), $50,000; Franco- Belgic Canadian Syndicate, Ltd. (not stated), $40,000; Regal Kitchens, Ltd., Montreal $50,000; Regal Paper Box Company, Ltd. (not stated), $50,000; Herman Silberman Co., Ltd. (not stated), $49,000; Co-operative Rainproof Garment Co., Granby, Que., $49,000; W. A. Marshall & Co. of Canada, Ltd., Montreal, $25,000.

DOES NOT LOOK LIKE ANY DROP IN PRICES

Market is Still Poorly Supplied—Some Peculiar Turns by the Price Inflation

TORONTO.—There is a certain amount of monotony attached to a week-after-week summary of any market, but it has been especially noticeable in the Toronto markets for some weeks and months now. It seems to make little or no difference whether reference is made to the steel, iron, or machinery market, the same conditions prevail—plenty of orders but a lack of material from which to fill them. It is not a pleasant nor a profitable experience for dealers to have to watch business coming to their desks day after day, only to be turned down or filled in small percentage of the total requirements.

Several dealers from this district have been in the American machine tool centres for the past week or so. They bring back little in the way of encouragement for better deliveries, and certainly nothing at all in the way of lower prices.

POINTS IN WEEK'S MARKETING NOTES

New York reports that there are lines now that sell at from 18 to 20 per cent. above the peak prices that were touched during the war.

—

The inquiry for machine tools which slumped in United States for a month or so is now coming back strong.

—

Canada uses annually about 250,000 tons of galvanized sheets, and of this about 3 per cent. is produced in the country. Shipments from United States are very satisfactory.

—

Small lots of boiler tubes arrived, but they were not a patch on the volume of unfilled orders booked here.

—

Large demand is reported for all lines of small tools and supplies, and the inquiries and orders are coming from a well-distributed list of industries, no one line doing the bulk of the buying.

—

Montreal expects the opening of navigation to do great things in the way of improving the transportation service.

—

The scrap metal market is inactive and dull this week. Little material is coming in, with prices firm and upward for such lines as stove plate, cast iron and heavy melting.

—

Machine tool dealers from this district who have returned to the city from U.S. plants tell of new wage scales being signed giving an increase to thousands of workers. In the light of this, and the present price of raw material, they fail to see any improvement in the selling prices of machine tools.

"While I was in Chicago," stated one of them to CANADIAN MACHINERY, "a new agreement was signed with the mechanics which gave tool makers $1.11 per hour. Others were in proportion, while the rate for helpers was 60 cents per hour. In the face of that I can't see where the talk of cheaper machine tools is going to have anything to stand on."

Several well-known British firms are opening up for the Canadian trade with offices in Toronto. It is understood that they have been assured by the head offices that shipments will be made very shortly for the Canadian trade.

Still a Starved Market

This week's advice from Pittsburgh tells of greater production in the steel mills, but, as stated in these columns before, the dealers here have failed to see any improvement in the deliveries. Galvanized sheets are the worst. Many of the warehouses have none of these in stock, and most of the shipments that are arriving are from the premium operators. The quotations are from 10½ cents per pound, but there are sales made at figures higher than this. Many of the jobbers feel that they would not be justified in quoting definite prices, which might commit other dealers who have to get their supplies as best they can from brokers or premium mills. The Canadian consumption of galvanized sheets, in normal times, is about a quarter of a million tons per year, while there is produced in this country some three per cent. of this amount. The duty has been very light, about 5 per cent. under normal conditions, and it has not appealed to Canadian manufacturers as a good field in which to venture. The result is that we are largely dependent on what we can get from the plants in United States. Some manufacturers are releasing stock that they will not require for some time, and in this way they are helping out the situation to some extent.

Some of the warehouse interests are inclined to hold that the tardy deliveries of the past month have been a blessing in disguise. They claim that the rate of exchange is much more favorable now than it was a few weeks ago, and payments will be made for material received at a much more favorable price.

One Toronto representative left on Wednesday for New York and Pittsburgh to see what could be done in the way of getting tubes over in greater quantities. A car came in last week, of assorted sizes, but that amount was hardly noticed against the orders stacked up for this line, many of them being very insistent and much needed for urgent repair work.

Black sheets from the premium mills are coming in more freely than for some time. They are offered for resale around 9c per pound. There is no trouble disposing of them at this price.

Small Tools and Supplies

Taking the first three months of this year against the corresponding time in 1919 several firms have informed CANADIAN MACHINERY that their business is away ahead this year. They point out that last year at this time there was still a lot of war material in the market, and this was taking something from the regular channels of trade.

Some of the jobbers find themselves in a peculiar position at present. They are trying to keep their stocks fairly low, as they are afraid of taking on large amounts at the present high prices. The demand keeps up so well that they are practically sold out all the time. This works out in some unforeseen ways. For instance one Toronto firm has sent an average of $4,000 per month to a maker of pulleys but for the first two months this year the amount went to $20,000 per month. Business from other sources also came in on a similar scale and the firm is swamped. They have to buy great quantities of raw material outside and above their contracts, and they are paying a stiff premium in many cases. Against this all the product has been sold at the prices stipulated in their own orders. They could make money up to the estimated business for the year, but anything above that will mean a loss.

Scrap Markets Dull

There is little business being done in the scrap market. Much keener competition is being experienced for any offerings that may come up for disposal, as several large melting interests are out for suitable scrap. The brass and copper section continues weak and uninteresting, while nothing has come up to relieve the shortage in stove plate, heavy melting and cast iron scrap.

NEW YORK TOOL MARKET IN SOME CASES 18 PER CENT. OVER THE WAR PEAK

Special to CANADIAN MACHINERY.

NEW YORK, April 8.—The Eastern machine-tool trade had a good month in March and orders are coming in this month at a fairly good rate. While business slumped somewhat during the first half of March, it picked up during the latter half, and with some sellers was one of the best months they have had since the end of the war.

Prices continue upward and the end is not yet in sight. One Central Western manufacture of turret lathes and screw machines has advanced about 5 per cent., its present prices now being about 18 per cent. higher than the peak reached during the war. Some of the drill manufacturers are selling all drills for forward delivery subject to a possible increase of 10 per cent.

Some of the machine-tool dealers are apprehensive lest high prices tend to injure the machine-tool business seriously. At present buyers are more concerned about deliveries than price. The second-hand tool market is very active, because of the long deliveries on most lines of new tools. Large profits have been made on used tools.

The General Electric Co. continues to be the most prominent machine-tool buyer in the East. This company is buying more or less for all of its plants, but more particularly for the newly acquired Bridgeport, Conn., plant, and the Edison Lamp Works Division at Newark, N.J. It also has inquiries out for the Pittsfield, Mass., plant. Some buying has been done for Lynn, Mass.; Erie, Pa.; and Schenectady, N.Y.

Aside from the General Electric Co., the Van Sicklen Speedometer Co., of Toledo, Ohio, and Newark, N.J., is one of the most active buyers in this market. Inquiries have been issued covering 75 to 100 tools, mostly for the new plant at Newark, but some of the equipment will go to the Toledo plant. Several men formerly associated with the Splitdorf Electrical Co., Newark, N.J., recently became interested in the Van Sicklen Speedometer Co.

Other buyers of the past week include the Nathan Mfg. Co., New York; the Otis Elevator Co.. Yonkers, N.Y., and the Federal Shipbuilding Co., Kearney, N.J.

The Norton Co., Worcester, Mass., which has been represented in New York and other Eastern territory for many years by Henry Prentiss & Co., machine tool dealers, New York, will soon sell its grinding machines from its own office.

PREMIUMS ARE STILL HOLDING FOR PROMPT DELIVERIES IN STEEL

Special to CANADIAN MACHINERY.

PITTSBURGH, April 8. — Generally speaking, the iron and steel market has been quiet the past week, even quieter than in the preceding week. Production has continued to increase and is now at a rate not far from what was recently considered the full capacity, but with transportation difficulties and a few minor restrictions to production out of the way still heavier production is in prospect.

Soaring Coke Prices

An exception to the general condition of there being little in iron and steel by way of new developments is the activity in the Connellsville coke market. Government price control had been announced to terminate at the end of March, and this gave the trade an opportunity to arrange transactions for shipment and invoicing April 1 or later. The termination of Government price control ended a number of arrangements that existed between producers and consumers, whereby during the period coke would be shipped and invoiced at the Government price. Also, there were a few regular contracts for coke which had been made for the first quarter of the year only, and these came to an end at the same time as the price control. Thus a considerable tonnage of Connellsville coke was released for sale in the open market, while at the same time a considerable tonnage of consumption became uncovered through the expiration of these contracts or arrangements. The course of the market in the past few days indicates that the consumption needing to be covered was greater than the production needing to be sold, for the initial market transactions were at 50 per cent. over the Government price and then there were sharp advances from this basis.

The Government price limits on Connellsville coke had been $6 for furnace coke and $7 for foundry coke, per net ton at ovens. The initial sales of furnace coke when the open market began were at $9, there being a few odd lots of prompt, a fair sized tonnage for the month of April and a small monthly tonnage for the remaining nine months of the year. There is a report that a scale was made for the second quarter also at $9, but this has not been fully confirmed. The market stood at $9 only for a day or so and then it began to advance sharply. As furnaces were indisposed to pay such high prices for any length of time the trading settled down to April deliveries only, and successively higher prices developed, the market at present being $11 to $12 for furnace and $13 to $14 for foundry, prompt or April delivery. The $12 figure for furnace coke is not an asking price, but has actually been done on no inconsiderable tonnage of coke of good grade.

It is said that certain consumers are not unwilling to pay coke operators what is obviously a very fancy price for coke, as an offset to the coke these consumers received from them during the control period, since coke was regarded as worth more money than the Government limit, this being proved by the contracts that had been made prior to the resumption of control. For the general future, however, it does not seem at all probable that $12 is going to obtain on coke, or even $9. The blast furnaces are able to pay the price, so far as that goes, since they have a large margin on pig iron they have sold at $40 and higher, but there is likely to be a good bit of competition in coke when the by-product ovens are again well supplied with coal. Part of the demand for Connellsville coke in the past few months has been due to the restricted output of the by-product ovens.

Pig Iron

The jump in the coke market stiffened the backbone of the merchant furnacemen, who have been firmer in the matter of pig iron prices in the past few days. Generally speaking, however, there does not seem to be much basis for expecting higher prices for big iron, while there may easily be lower prices in the near future. Present prices are too high for the steel industry, $40 pig iron being quite out of line with prices the steel mills that buy their pig iron are likely to secure for second half, and it must be remembered that a considerable proportion of the pig iron made by the merchant furnaces is sold to steel works. Various odd lots of pig iron are being offered in the market by holders who are not producers and who are not ordinarily engaged in buying and selling pig iron.

The market remains quotable as follows: Bessemer, $42; basic, $41.50; foundry, $42, f.o.b. valley furnaces, freight to Pittsburgh being $1.40.

W. P. Snyder & Company compute each month the average prices of Bessemer and basic iron, by taking all the sales of valley iron reported in lots of 1,000 tons or over, and striking an average of the whole tonnage. Their averages as computed for March are $42 for Bessemer and $41.50 for basic, at valley furnaces, or precisely the figures at which the market has been generally quoted. There had been a contention that sales had been made at $43, but this average, which is semi-official, does not confirm such claims.

It is only three or four months ago that the iron and steel trade was full of talk that the furnaces and mills would not be able to function well for a long time, as if the normal condition of the plants making new output records from time to time, when they had the orders to work on, had been permanently lost, to be succeeded by a condition in which something or other would always be wrong. Production of late has not been justifying such forebodings, but on the contrary has been at such high levels as to make it appear probable that the iron and steel industry will in the near future not merely produce at what was considered its capacity, but at greater rates still, necessitating a revision upwards in the estimates of capacity. While pig iron capacity has hitherto be taken to be 43,000,000 or 40,000,000 tons a year, it may be that output will prove 5 to 10 per cent. above that if demand continues heavy. Steel ingot capacity has been taken at 49,000,000 or 50,000,000 tons a year, but may eventually prove to be about 10 per cent. above that.

Breaking of output records has indeed begun already, not a few plants or departments having done better last month than ever before. The most notable case is that of the National Tube Company (Steel Corporation) whose output in March was the best on record, and not by a small but rather by a large margin. As this company produces about 4 per cent. of all the finished steel of the country, the case is an important one. Thus far, however, breaking of records has been very far from general. April and May are likely to show much more in that direction.

Transactions in steel products have been light all along the line. There is a small but insistent demand in a few quarters for prompt lots, and with offerings so limited the premiums for prompt shipment do not decline very rapidly. The larger mills, that have a policy now of selling quarter by quarter, have not formally opened their books for third quarter, and seem to have found that their customers are not anxious for them to do so, seeing that prices would probably be $10 or $15 a ton above the schedule at which the Steel Corporation continues to sell to regular customers, and for the later deliveries it has to offer.

SHORTAGE OF MATERIAL MAKES IT HARD FOR THE RAILROADS

LONDON, Ont. — A rather striking illustration of the manner in which the acute shortage of materials needed for construction work accentuates the general condition in the whole district is shown at the Grand Trunk car shops here. Under normal conditions between $500,000 and $600,000 worth of timber, nails, steel and iron, paints and similar materials are kept in stock and from $200,000 to $300,000 worth is used up every month. Sometimes two carloads of nails are used in a week in rebuilding cars.

For some time past the supplies have been coming in in such small quantities that it has been impossible to do anything like the usual quota of work. This means that cars which are badly needed for transporting coal and all sorts of merchandise have to lie idle because it is impossible to get the materials with which to rebuild them. Orders for some kinds of nails are as far behind as October. It is impossible to get some lines of steel and iron goods at all.

It is expected, however, that there will be a gradual improvement in shipments of steel and those in charge of the big shops are looking for a steadily growing output of steel cars and a corresponding decrease in the number of wooden cars. The extremely high prices which have to be paid for the high grades of wood required for car construction and the great difficulty in obtaining timber will mean, they say, that it is only a question of time before only small quantities of lumber will be used in buildling cars.

Work will be commenced shortly on reclamation yards here for the Grand Trunk. These will cost approximately $500,000 and it is hoped that by sending in all the wreckage from the entire district that several hundred thousands of dollars will be saved every year. At the present time, if a car is smashed much of the timber in it is burned to get rid of it. The steel and iron work goes to junk dealers, many of whom have been making big profits. Under the new plan, all timber that can be used again will be saved. Iron or steel which cannot again be used for the original purpose will be made into bolts or bars or some other parts instead of buying new ones. Those not in touch with the situation have no appreciation of the number of cars which are either partially or badly wrecked each month or of the large sums required to put this rolling stock again in commission.

CANADIAN STEEL CAN SELL IN JAPAN

Demand Exists and There is Difficulty in Supplying Material at Present

Trade and Commerce Department Bulletin, in a recent issue, says:

Canadian mills should be able to do considerable business with Japanese importers during the present year. Last year the market here was overstocked in a great many lines, owing to the fact that heavy orders had been placed before the armistice, the goods not coming to hand until after the various Allied Governments had lifted all export embargoes. Then, again, Japanese buyers held off buying on account of the high prices, thinking they would decline. As a result stocks are now very low. The building trade was very dull during the past year, contractors thinking the price of steel shapes would drop. Men in the trade now say that there will be a big demand this year for steel shapes, and in fact steel of all kinds. Cargo from the United States has been delayed by three months owing to the recent strikes in that country, so that it is expected supplies will be slow in coming forward. On account of the great demand of their own markets, Japan cannot count on receiving supplies from Europe. There would therefore seem to be a good market here for Canadian steel during the coming year. Several inquiries have recently been received at this office for 12-pound rails, but business cabled to Canadian mills showed that it was impossible to obtain deliveries in the near future.

DEVELOPMENTS IN NEW BRUNSWICK

Preparations are being made by the Canadian Pacific Railway to construct another traffic bridge across the falls at St. John. It will be ready for traffic in 1921.

A new factory for the manufacture of automobile springs is about to be started by J. E. Arrowsmith.

The Corona Candy Company has lately enlarged its chocolate manufacturing premises on Union Street, by the addition of another storey to its plant.

Plans for a new Baptist Church at Moncton to cost $100,000 are being prepared by C. L. Archibald, of St. John.

The work on the erection of the two Fraser lumber mills just above Campbellton has been completed.

A potato flour mill to cost $60,000 is to be erected at Woodstock.

A sawmill for the manufacture of long lumber is to be erected at Kennedy Island, Upper St. John River.

D. W. Clark, manager of the Canadian B. K. Morton Co. of Montreal, will leave for England on the 23rd of the month, in connection with new developments of the company. He will be away about six weeks.

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The Magnetic Chuck, Its Design and Varied Uses

The Magnetic Chuck, as a Work Holder, Has Proved Its Usefulness Beyond Question. The Fundamental Principles of Design, Together With Varied Uses of This Style Chuck Are Discussed

By J. H. Moore

WHILE magnetic work-holding chucks have passed the novelty stage, and have proved their usefulness and adaptability to varied classes of work, there is unfortunately still that class of mechanic existent who looks at you in a sort of a puzzled manner the moment you suggest his using such a type of chuck. This lack of knowledge on the part of a few is much to be regretted, but is existent only because they have never been enlightened as to their many uses.

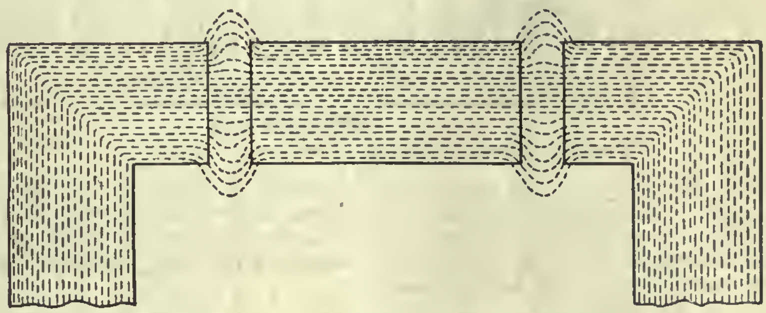


Figure 2.—Neutral pole inserted in the opening of the magnetic circuit on Fig. 1.

The chief trouble is that they are somewhat distrustful of its holding power. They cannot comprehend how electricity can successfully combat with the counter force exerted by the grinding wheel or cutting tool as the case may be. It is only reasonable to believe that were the uses of this type of chuck better understood they would increase in general popularity.

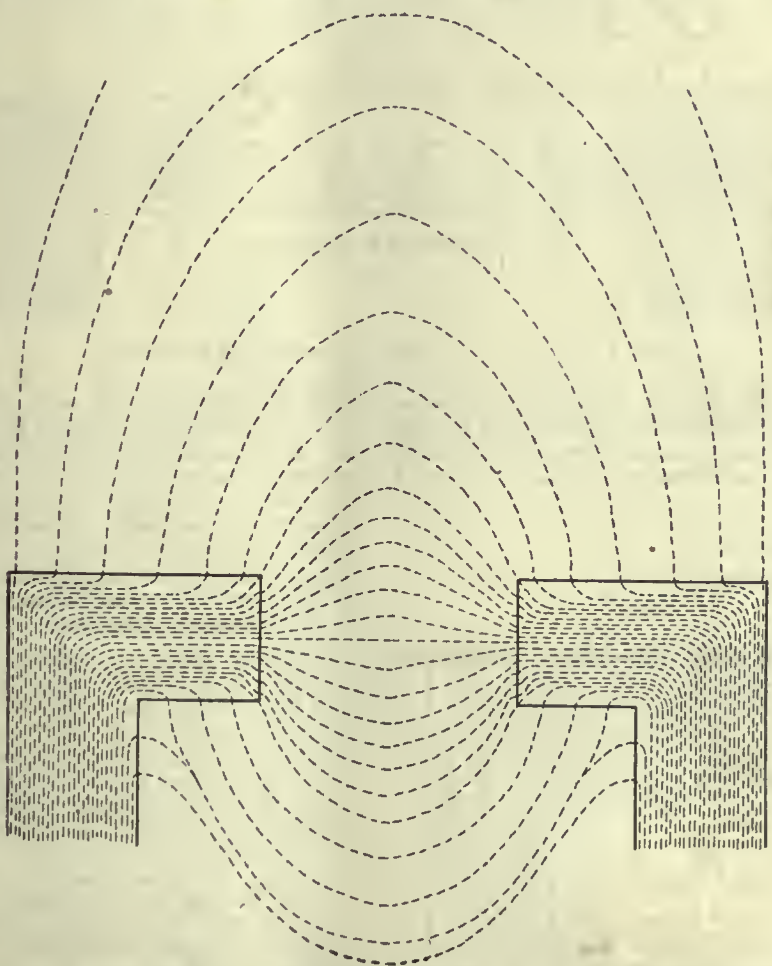


Figure 1.—Open Magnetic Circuit, being a portion of the circuit shown in view with a section cut out.

Believing an article along these lines would interest our readers, we will go into a discussion of the Simmons Unit pole magnetic chuck, illustrating the same by diagrams and photographs. It is through the courtesy of the Taft-Pierce Co., Woonsocket, R. I., that we are able to present this matter, and all illustrations shown are from actual installations.

To commence with, it might be well to consider certain fundamental principles of magnetic circuits as applied to chuck construction.

Magnetic Circuit

The quantity of magnetism that is produced in a given magnetic circuit is determined by the following factors:

1. Magnetic (or magnetizing) force, expressed in ampere-turns.
2. Magnetic capacity (or permanence) which depends upon the material and the dimensions of the circuit.

Magnetic force in electromagnets is produced by electric current passing through a coil of wire wound around a portion of the magnetic circuit. Suppose you had a magnetic circuit of one material throughout, and that you had a coil made up of ten turns, with ten amperes running through it. This would

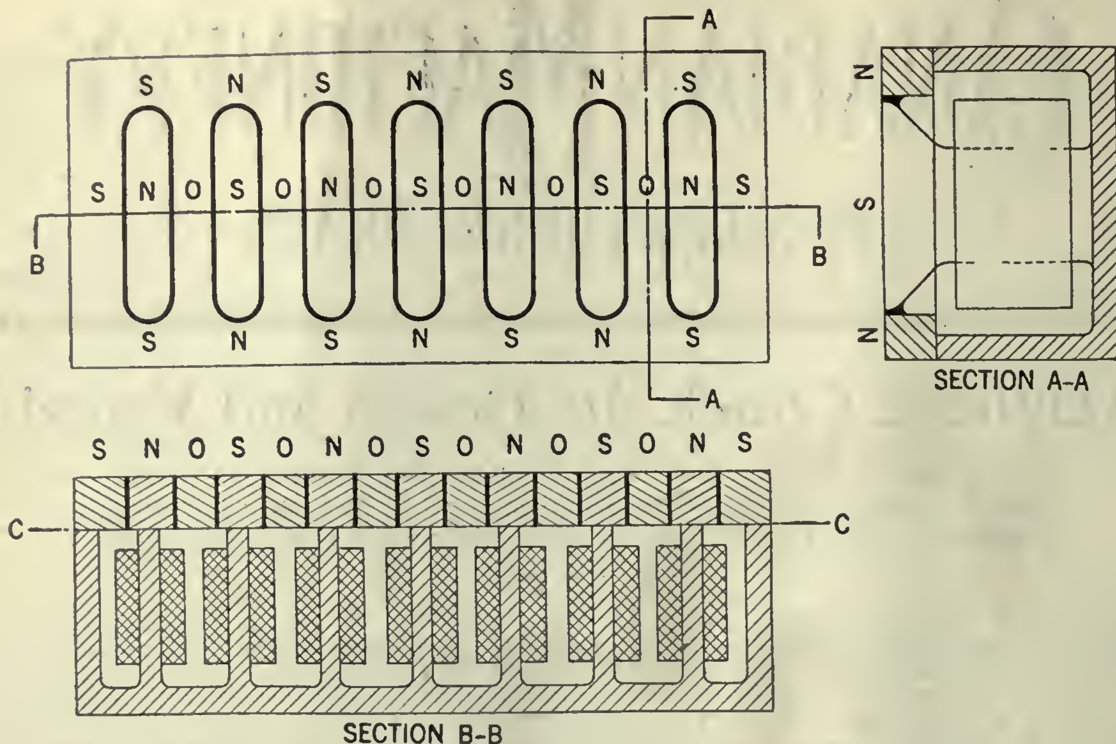


Figure 3.—Magnetic Circuits of a Multiple-Pole Chuck with a Neutral Pole between each adjacent pair.

mean that the ampere turns would be one hundred. The ampere turns that can be used in a given magnet are limited by the space available, and the provisions that are made for carrying off the heat produced in the coil.

The magnetic capacity (or permeance) of the magnetic circuit is determined by the material of the circuit and its dimensions. If the permeance is designated by the letter P we have the following equation: $P = u \frac{A}{L}$. A represents the cross sectional area, and L the length of the path. u is what is termed permeability. u is a property of the material and measures the magnetic capacity of the material. Iron, generally speaking, has by far the highest permeability of all materials. There are a few others that have an appreciable permeability, but even these are far inferior to iron.

The unit of permeability is the permeability of a standard volume of air, so that the value permeability of any given substance is always expressed in terms of that of air. The permeability of iron changes with the amount of magnetism present in the iron. Beginning with low densities, it rises to a maximum value and then decreases approaching 1 (that of air) as the metal becomes saturated with magnetism. Following is given a list of maximum permeability values for several kinds of iron:

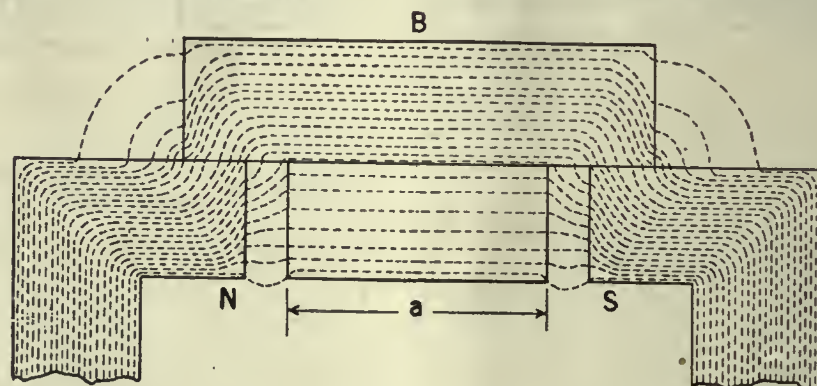


Fig. 4.—Piece of work bridging the neutral pole completely.

From the foregoing it is seen that the kind of iron used has a vital effect upon the efficiency and holding power of a magnetic chuck, not only because of the variation in maximum permeability, but also on account of the value of magnetic density in lines per square inch at which the maximum permeability occurs.

The effect of the change in permeability with magnetic density causes what is known as Saturation.

When we open any magnetic circuit the lines of magnetism must jump the gap through the air. This magnetism will take the path of least resistance, and since the distance decreases with the cross-sectional area of the path, and increases with the length, the magnetism will spread considerably around the opening as shown in Figs. 1 and 2. This spreading is termed leakage, and the greater the gap and the magnetic force available, the greater the leakage, as shown by comparison between the two figures.

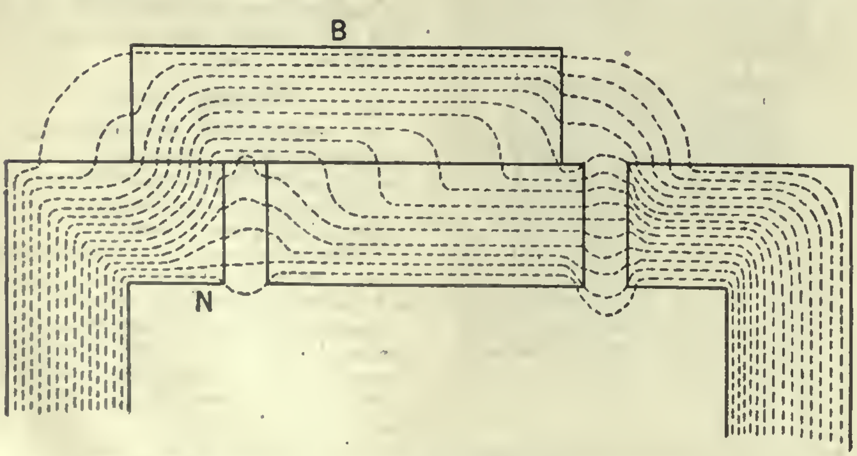


Fig. 5.—Piece of work bridging only half of neutral pole.

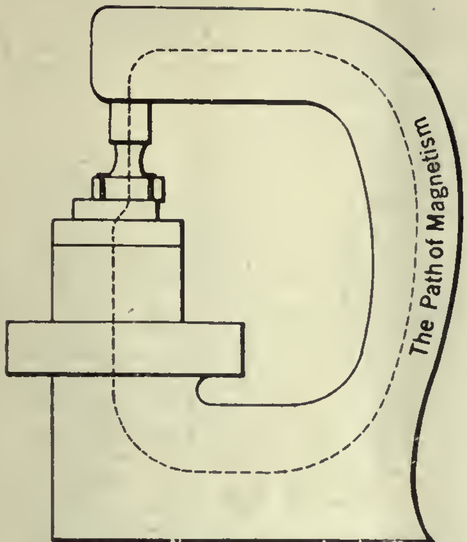


Fig. 6.—Diagram showing path of magnetism that can be shunted around neutral-pole and single-pole chuck.

To minimize leakage the air gap must be decreased in length and cross-section to a minimum and the iron must be worked below the saturation point. The dimensions and proportions of the magnetic circuit should also be so chosen as to make the path of least magnetic resistance (called reluctance) definite and coincident as nearly as possible with that considered theoretically desirable.

The pull exerted by a magnet upon a piece of iron included in its magnetic circuit depends upon two main factors, namely:

1.—The quantity of magnetism or flux that passes between the poles and the piece.

2.—The area of the piece in contact with the pole faces.

The quantity of magnetism or flux is expressed thus:

$\Phi = (FP)$, in lines 2

where Φ is the total magnetism, or flux in lines, F is the magnetic force (called a magnetomotive force) and P is the permeance of the circuit.

The former equation given shows the method of calculating P for a given circuit of uniform section and material throughout. When the section of the circuit and the material varies, it is usual to assume various values of flux density, B, measured in lines per square inch, and determine from a saturation curve of the material the magnetomotive force in ampere-turns required to establish that flux in each portion of the circuit. Adding these magnetomotive forces together for each value of flux it is possible to plot a saturation curve of the whole circuit and with this coils can be read directly from the chart.

If the flux is known, the pull then becomes simply a matter of area of contact between the piece and the pole faces of the magnet. Careful scientific tests have shown that the pull under such conditions is expressed thus:

$$P = \frac{1}{8\pi A} \Phi = 0.398 \frac{\Phi}{A}$$

wherein Φ is the magnetism (flux) in lines, and A the area of cross-section between the poles and the piece in square inches.

With these few principles in mind it is now possible to make an interesting comparison of several fundamental types of magnetic chuck structures, bringing out some of the principal advantages and disadvantages of different types of construction.

Basic Magnetic Chucks

In Fig. 3 we show the general design of a multiple-pole type chuck employing

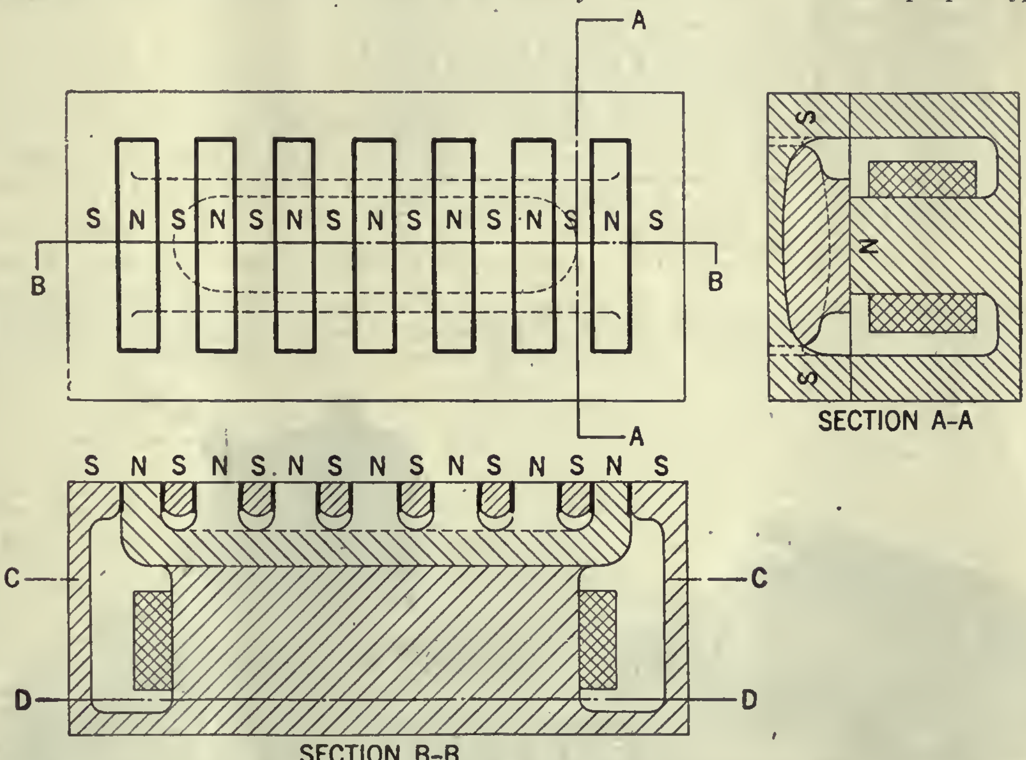


Fig. 7.—Magnetic Circuits of Single-pole Chuck. The slots may run either across or lengthwise of the chuck.

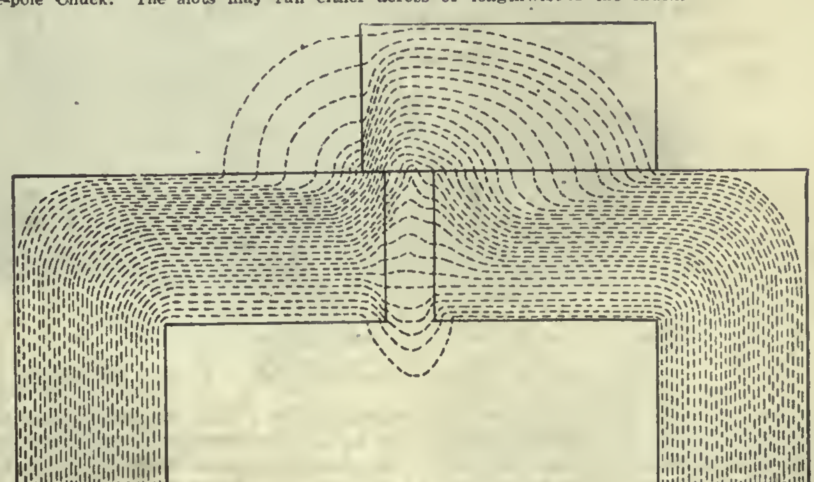


Fig. 8.—A small piece of work, placed non-symetrically, showing saturation on one side.

a magnetic circuit similar to that in Fig. 2. It is made up of a series of pole pairs formed integral with the body of the chuck on one end, each pole being equipped with a coil so wound and connected as to give alternate north and south poles.

The face plate of this chuck is made up of a grid casting, the openings in the grid providing proper space for pole pieces, the pole pieces being held in position by filling the space between them and the grid proper with a suitable non-magnetic metal.

The purpose of using a grid with bars between the adjacent poles is to secure an even and uniform spacing of pole faces. The effect of this method of construction is to reduce leakage when there is no work on the chuck and to increase leakage when there is work on the chuck. Referring to Figs. 1 and 2 we see that placing a piece of magnetic material in the gap of the circuit shown in Fig. 1 has reduced the leakage of flux to a comparatively small area by reducing the air gaps. However, in Fig. 4 we see that placing the work, B, over the two adjacent gaps does not lead all the magnetism through the work, but an appreciable portion of it passes through the intermediate piece, a.

(To be continued)

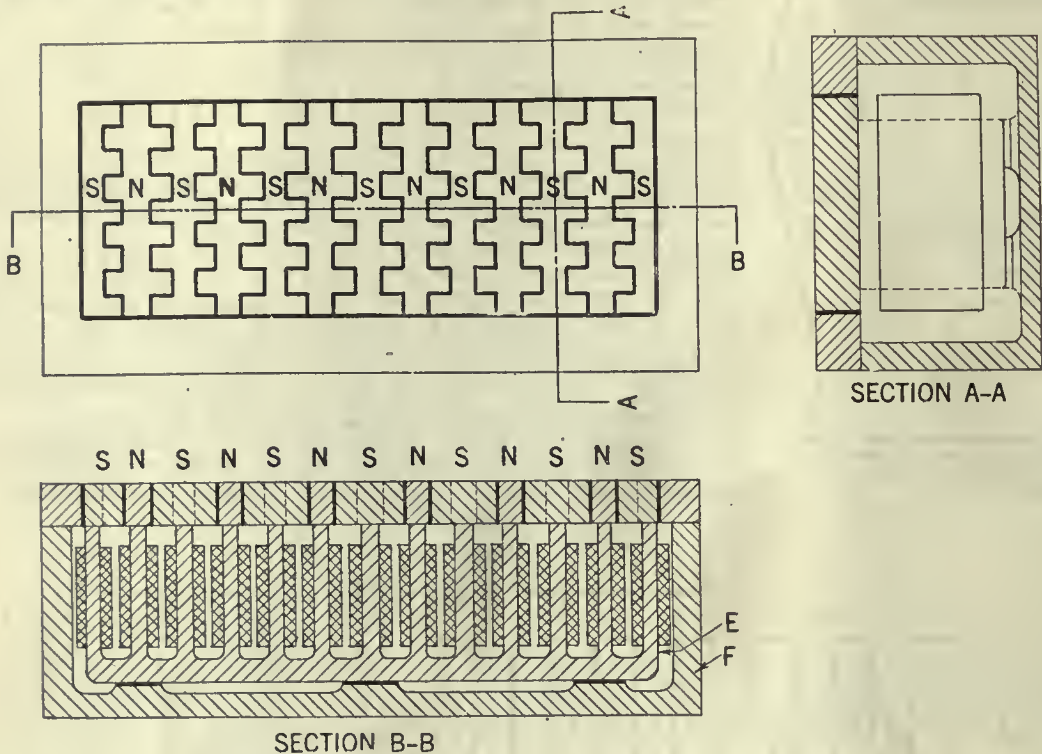


Fig. 9.—Magnetic circuit of Simmons Unit-Pole Magnetic Chuck.

FIG. 10.—Complete disassembled view of 8 x 10 T-slot Simmons Unit-Pole Magnetic Chuck.

Measuring the Temperature of Molten Steel

A Paper Read Before the American Foundrymen's Association on the Comparison of the Different Methods Existent. The Pyrometer, Rod Test and Other Methods Are Discussed

By F. W. BROOKS

A LARGE number of trials and experiments have been carried out by steel makers, along with the very commendable support of the makers of pyrometers, to try and put the measurement of molten steel upon a scientific and fairly reliable basis. Most of the practical investigators have known all along that the measurement of actual temperatures, to any degree of accuracy, is at present too much to aim for, and have contented themselves with the effort of finding some indication, such as a reading on an instrument, which tells them when the steel is at the best temperature to produce either a certain type of casting or a first-class ingot with the particular composition of steel they are handling, and that each time this reading is obtained the steel is at its best pouring temperature. In other words, comparative tests have been their chief aim.

Use of Pyrometers

Of the scientific instrument methods, we may consider thermo-couples, radiation pyrometers, and optical pyrometers. The thermo-couple for temperatures of heat treatment has proved valuable. In the measurement of molten steel, however, only the rare metal couples can be considered, and even these do not withstand the very severe conditions of a bath of molten steel. Protective tubes, such as quartz tubes, have been tried, but have certain disadvantages. The mechanical strength of a long tube at the high temperature is inadequate; the chemical reaction of the slag, in the case of basic operation, is undesirable; and the varying thickness of the coating of slag to the tube, as it is pushed through the slag, causes a varying lag of temperature from the steel to the couple.

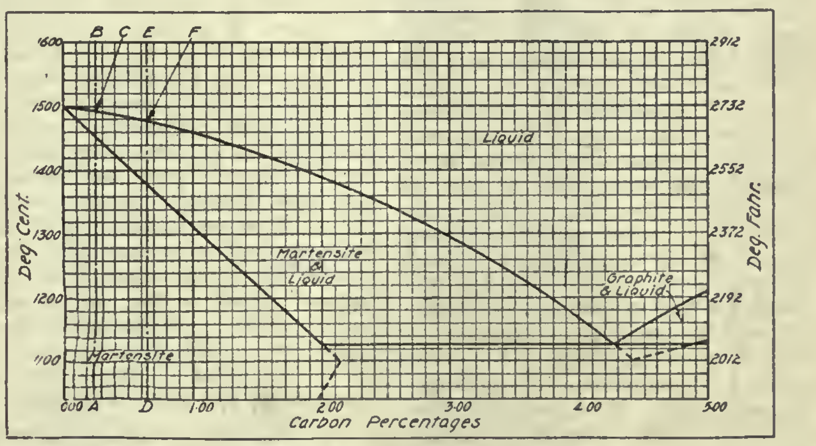
The radiation pyrometers, of which the Thwing or the Foster type of fixed focus pyrometer appear to be most satisfactory, require no focussing, and the method of handling them is simple. Both of these instruments also have an attachment for taking care of the change in black body conditions from true black body conditions when steel is poured from a furnace or from a ladle. The accuracies of these attachments are not so important, as they are the same for each heat, as long as the steel is in a completely molten state. The first obvious objection is that, owing to the slag covering in the furnace, and the difficulty and objection of maintaining an uncovered patch, the temperature cannot be read until the steel is being poured into the ladle. While this only allows for correction of temperature in one direction, it still has several valuable advantages. If the temperature of the steel is too low, preference can be given to the heavy castings of large section, and the pouring operation carried out as rapidly as possible. If the temperature is on the high side, the steel can be left in the ladle, or preference given to all the small castings requiring a relatively higher temperature; but perhaps the greatest value is a check and guidance for the melter and the foundry superintendent on the now existing more or less crude practical methods to be explained later. In the open-hearth furnace, when consecutive heats are being run to the same analysis and same conditions, a certain difference of temperature between the steel and the slag may be assumed; but this is not very reliable.

The principal objection, however, in the use of radiation pyrometers is the difficulty of always being able to focus through a clear atmosphere and onto a clean stream of steel. In actual practice, it is found that smoky atmospheres and incandescent gases are constantly interfering, while in many furnaces the slag comes out of the teeming spout along with the steel, and it is very difficult to know which of the readings recorded represent true conditions, or the same conditions as on the previous heat. There is also a tendency on the part of the observer to record the highest reading on the instrument, and interference of a small amount of incandescent gas can escape notice. The following readings are typical of many tests made of a stream of steel leaving the nozzle of a ladle when pouring castings of easy section of about 30 to 100 pounds in weight and 0.25 to 0.35 per cent. carbon, by the same instrument and the same observer, the resulting castings being of first-class quality.

Heat No. 7			Heat No. 23.		
Mold	Degrees Cent.	Degrees Fahr.	Mold	Degrees Cent.	Degrees Fahr.
1	1510	2750	1	1530	2790
2	1560	2840	2	1540	2800
3	1515	2760	3	1210	2210
4	1740	3170	4	1560	2840
5	1530	2790	5	1490	2710
6	1580	2870			

It is obvious that the readings on the fourth mold of heat, No. 7, and the third of heat, No. 23, were decidedly off, although every care was taken on both these heats to get uniform conditions, and the error is undoubtedly due to incandescent gases and smoky atmosphere. Results, both better and worse, were obtained, and these are given as typical when every care was taken.

Practically the same limitations are noticed with optical pyrometers as with the fixed focus radiation type, the added disadvantage being that with every type of optical instrument there is more of the personal element brought in by the matching of intensities or the matching of colors. On the other hand, they are not so liable to damage by the too close proximity to the molten metal, as an observer has less fear of sticking a long tube up to the stream than of bringing his face too near.



STANDARD CARBON-IRON CURVE.

Of the practical methods known, the film, rod and pouring tests are in constant use at various electric furnace plants, and they are all depending upon uniform conditions existing when each test is made. The use of the film test originated from the crucible steel practice, it being the best practice in making tool steels to first close all the melting shop doors; then to pull the pots after the required stewing and remove the lid and slag; make any additions and then carefully watch the bright surface of the steel for the first sign of an oxide film forming, this being the sign to commence pouring operations. In the absence of drafts, this served as a fairly reliable temperature indicator, as the crucibles and the mass of steel were usually the same, while the varying composition of the steel could be allowed for by pouring as soon as the first speck appeared, or so many seconds later. In electric furnace practice, this consists of using a steel spoon of uniform capacity, dried out thoroughly over the bath, and giving this a total covering of slag in the furnace. A sample of steel should then be taken, which fairly represents the whole bath, remembering that when a door has been left open for some time the steel near the door has become chilled, and with steel made in an electric furnace where all the heat is applied at the top only, the temperature of the steel directly under the slag is higher than the temperature of the steel near the bottom. Where this is the case, the bath must be thoroughly rabbled before any sample is withdrawn, and even then the sample should be taken at a place equidistant between the electrodes and half way down the bath, so as to arrive at an average temperature. The measurement of the temperature is then indicated by the length of time it takes for an oxide film to completely cover the sample after the sample is taken from the bath. This method is also influenced by the composition and physical condition of the bath, as for molten steels of the same temperature this time varies, principally with the carbon contents, the silicon contents, other alloy contents and the state of deoxidization. Therefore, final comparisons must only be made between steels of approximately the same composition and when the furnace is ready to pour. Care must be taken to keep the sample away from drafts and to have about the same amount of steel in the spoon each time. To show the range of this test it has been noted that first-class high-speed steel ingots of a composition approximating carbon, 0.65; tungsten, 17.5; chromium, 3.75, and vanadium, 1 per cent., were produced when the film (with a later characteristic wrinkling of the surface) was formed directly the sample spoon came through the door, while good castings of about 0.25 carbon and weighing from 30 to 200 pounds were produced when the film took 60 seconds to form after the furnace door.

Factors Affecting Use of Rod Test

The rod test has been used for many years as a rough indication of the temperature of many molten metals. The first publication noted by the author of this test being made a standard practice under uniform conditions was from a large Italian steel works. This test requires the use of rods of steel of both uniform diameter and fairly uniform composition, and consist of plunging the rod into the bath of steel and gently moving it through the bath for a uniform length of time. If the steel is cold there is a deposit of the bath on the rod, if the steel is hot the bath melts away or bites into some of the rod, with all intermediate conditions indicating varying temperatures. The skin of the bar, it will be noted, has an effect on this test; a newly rolled bar with a bright scaly surface tends to show a colder bath than is actually the case. The bar before being plunged into the bath should be of uniform temperature and in some steel works this is taken care of by bending about 12 inches or more of the end of the bar at right angles; holding the bar with the bend in a horizontal plane over the bath until it shows the first sign of sagging and then turning the end of the bar into the bath. This test again depends on the physical condition and the composition of the bath. This test is also very useful for testing the difference in temperature between the top of the bath and the bottom of the bath and is one of the best indications of the value in electric furnaces of the bottom heating type.

Temperature is Indicated by Fluidity of Metal

The pouring test consists of using a spherical spoon of above 5 inches diameter and carefully slagging up this spoon over the bath. Dip the spoon quickly into the metal so as to get a sample of the steel from about the centre of the bath. Withdraw the sample and carefully pour out the steel over the lip of the spoon at a slow, even rate. The temperature of the steel is noted by its fluidity, and by the amount of steel skull that is left on the spoon. This test is the one most commonly used in steel foundries. It is simple and the very nature of the test gives confidence to the man who is responsible for pouring the heat. If he sees every drop of the steel pouring nicely over the lip he feels that in pouring from the ladle itself the castings of small section will fill up and there will be no skulls left in the ladle. This test is subject to the spoon being properly slagged up, the rate of pouring the sample, and absence of drafts.

For all these practical methods too much emphasis cannot be placed upon the fact that they are all comparative tests only, and that they depend entirely upon uniform conditions, and attention to details. In all cases at least two of these methods should be employed. They do not, of course, indicate to the melter the temperature of the steel in degrees, Cent. or Fahr., but they do give him a very good indication of the degrees of temperature that the steel is either above or below the temperatures which will give him the best results for the composition of the steel he is handling, for the weight and for the type of casting he is making. In making steel castings it is important that the foundry foreman or superintendent be present when the final temperature tests are being made. He is in a much better position to know how hot the steel must be to suit the castings on the floor. To tell the melter that the castings are averaging 30 pounds and then to leave the decision regarding the temperature up to him, is not sufficient.

The question most frequently asked while trying out the above tests was: "How accurately can you measure the temperature of the steel and what temperature should the steel be when it leaves the furnace to give the best results?" The first part of the questions refers to the use of the pyrometers. On steel works, where the best conditions for the pyrometer can be obtained, there is still the limitations of the pyrometers themselves. As already explained, only the optical and the radiation type offer a good field for these high temperatures and conditions, and there is little doubt that an error of plus and minus 50 degrees Fahr. in the instrument itself is all that we can ever expect. To an investigator first starting in with a new instrument he has just bought, this may not sound very encouraging, as he naturally feels that if the steel proves to be 50 to 100 degrees Fahr. less than what he is aiming for he will spoil some of his castings. The other limitations of focusing and atmosphere have already been described and values given.

Probably the best reply to the second part of the question is that the temperature in question is that at which the particular steel begins to solidify, plus the loss of temperature from when the reading is taken to when the steel gets to the farthest end of the thinnest section in the casting. A further query to this second part of the question invariably was: "But how are we to know what these two values are?" The first value depends on the composition of the steel, the carbon contents being the principal factor. This can be obtained by reference to a standard carbon-iron curve, such as shown in the accompanying illustration. For a steel containing 0.25 per cent. carbon, trace the line A B till it intersects at C, giving a value on this curve of 1492 degrees Cent. (2720 degrees Fahr.); for a steel containing 0.65 per cent. carbon, trace the line D E till it intersects at F, giving a value 1476 degrees Cent. (2690 degrees Fahr.), and so on. For other elements in the steel commonly used in castings the variation is not of importance and does not compare with the many other sources of error that crop up in reading the temperatures of molten steel in a foundry. The second value depends upon such variables as the heat of the ladle, the thickness of ladle lining, time of reading to pouring, whether molds are of dry or green sand, and thickness and lengths of the thinnest sections. All of these factors depend very much upon local conditions, and it is regarding this problem that constant consultation between the man responsible for the steel in furnace and the man responsible for making up the molds is so valuable. Final results are only obtained by the constant comparison of the quality of the final castings with the results obtained by their methods of reading the temperatures of the steel.

Designing Foot Levers for Brake Wheels

This Chart Should be Especially Valuable to Designers Having Any Occasion to Use Foot Levers. The Author Assures Us That These Sizes Can be Depended Upon

By JOHN S. WATTS

THE chart which accompanies this article will be useful in designing foot levers for brake wheels on hoists and other machines, and the dimensions given therein may be used with every assurance that levers made to these sizes will withstand the roughest of treatment without appearing at all clumsy or too heavy.

In calculating the length of lever required, it is necessary to decide the push which can be given by the foot of the operator on the end of the lever, and this chart gives the choice of two amounts, namely, thirty pounds and sixty pounds.

A push having the weight of thirty pounds, should be used when the lever is to be operated frequently with the full load on, and sixty pounds may be taken when the full load is to be taken only occasionally, and the operator has not too many other levers to operate.

To use the chart, having the moment in pounds that is required, follow along the horizontal line on the chart for that moment under the push (30 pounds or 60 pounds) decided upon, and we get the width of boss, diam. of shaft, section of arm and length of lever required. The section of the lever at the foot end is common to all as the strain at that point is the same for all levers.

Two shapes are shown for the foot end of the lever; one is suitable for those cases where the operator stands to one side of the lever and the other for when he stands at the ends of the lever. Both styles are simple to make and will afford a good foothold, with no danger of the operator's foot slipping off the lever. In actual use it will be found that there is sufficient surface provided to enable the operator to put his whole weight on the lever without discomfort. If desired the surface where the foot rests may be scored to provide a surer grip, but this is not really necessary except where the lever may get coated with grease or ice.

In order that the chart may be used with intelligent confidence, the basis from which the various dimensions are calculated and the stresses used are given below.

No matter what push may be sufficient to give the required moment on the lever provision must be made to take care of the very probable eventuality, that at some time or other some operator will put his whole weight on the lever, and even jump upon it, thus throwing a weight of say two hundred pounds on the lever suddenly.

For this reason two hundred pounds has been taken as the load in making up the chart so far as the strength required in the lever is concerned, disregarding entirely the thirty and sixty pounds used in calculating the moments for the various lengths.

On account of the shocks to which the lever is sure to be subjected, the stress throughout is limited to 6,600 pounds per square inch.

The moment of the lever, as given in the chart, is of course the length of the lever in inches, multiplied by the push, as noted at the top of the column, namely, thirty or sixty pounds.

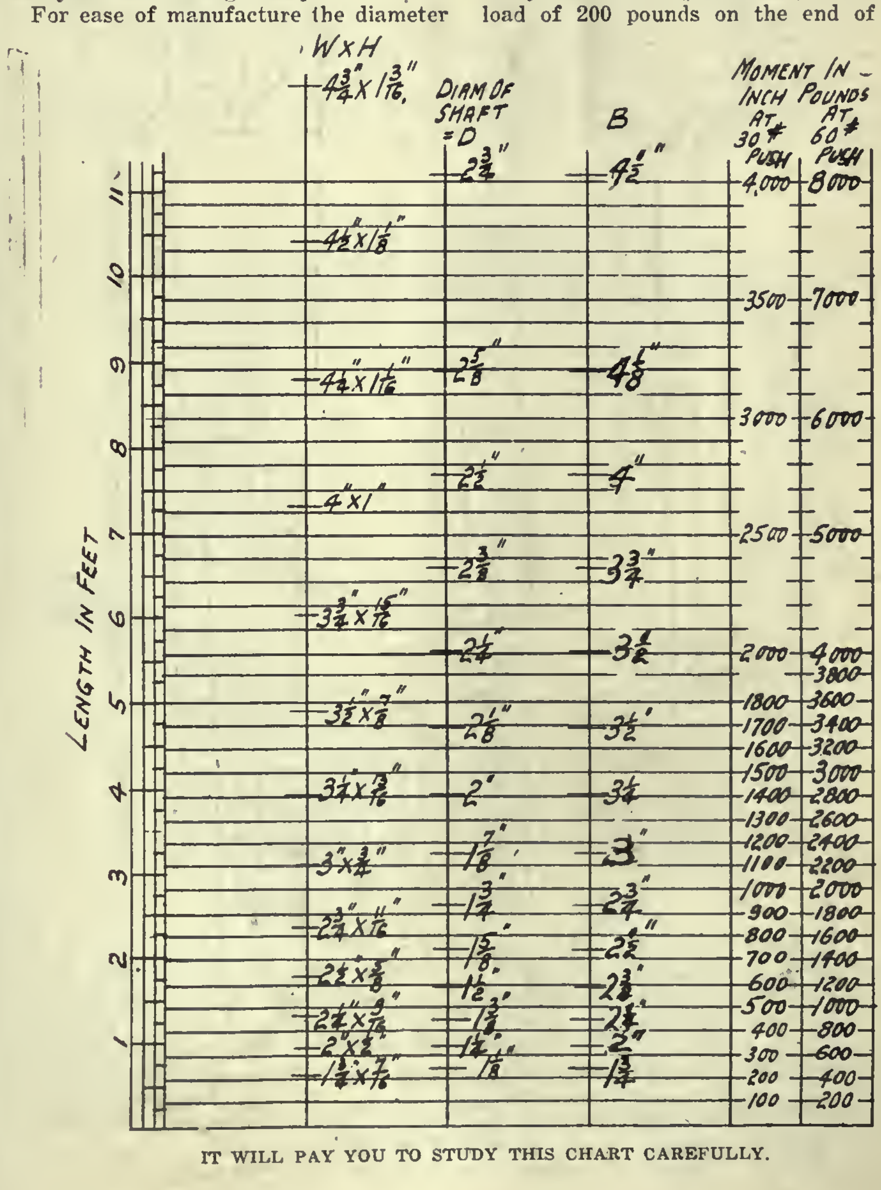
The width and thickness of the lever at the boss end W x H, is that section required to carry 200 pounds on the end of the lever, with a stress of 6,600 pounds per square inch, calculated as a cantilever with a concentrated load at the end.

The thickness of the lever, H, is in all cases one-quarter of the width, as this gives a section which will resist buckling sideways and still not be excessively heavy for the strength required.

For ease of manufacture the diameter of the boss is shown as being equal to the width of the lever arm, W. However, cases will arise when the diameter of the shaft will need to be increased above that shown by the chart to take care of other stresses induced in the shaft at another point. In such cases, so long as the diameter of the boss is not less than one-half inch larger than the diameter of the shaft, the strength through the boss will be equal to that at other points.

It is not essential that the boss be central with the lever arm, as shown, and the shape of the boss that is half circular and half square, is made that way, only for reasons of economy of labor in manufacturing.

The diameters of the shafts given by the chart are the diameters necessary to carry the twisting moment, due to a load of 200 pounds on the end of the



IT WILL PAY YOU TO STUDY THIS CHART CAREFULLY.

lever, with a stress of 6,600 pounds, and is determined from the formulae:

$$\text{Twisting moment} = \frac{\pi}{16} fd^3.$$

The width of the boss E is that found by assuming the width of the keyway to be one-quarter of the diameter of the shaft and making the length B, which is also the length of the key, such that the shearing stress on the key will not exceed 6,600 pounds per square inch. The load being that due to 200 pounds on the end of the lever.

The simplest way to arrive at the length of key required is to take the strength of the shaft as the basis, which is

Torsional strength of shaft in inch

$$\text{pounds} = \frac{\pi}{16} fd^3.$$

The shearing strain on the key will be this torsional strength divided by the lever arm of the key, which is $\frac{d}{2}$.

∴Shearing strain on key equals

$$\frac{\frac{\pi}{16} f d^3}{\frac{d}{2}} = \frac{\pi}{8} f d^2.$$

The shearing strength of the key equals

$$B \times \frac{d}{4} \times f$$

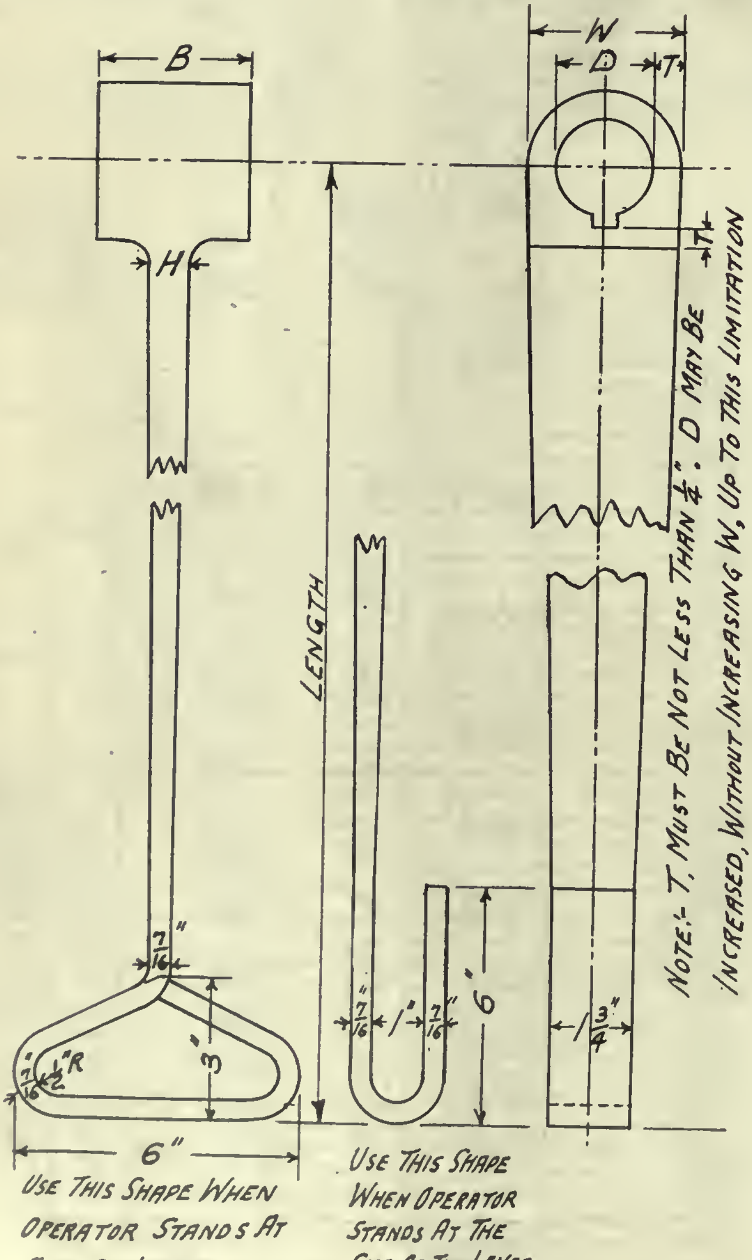
Therefore for equal strength of key and shaft at equal stresses

$$B \times \frac{d}{4} \times f = \frac{\pi}{8} fd^3$$

$$\therefore B = \frac{\pi}{2} \times d$$

$$= 1.5708 \text{ d}$$

Or, the length of the key should equal half the circumference of the shaft when the key is to develop the full strength of the shaft.



VIEW OF LEVERS WITH ALL NECESSARY DATA.

ENGINEERING SECTION'S SPRING CONFERENCE

The first spring meeting of the Engineering section, National Safety Council, is to be held in the Engineering Societies' Building, New York, April 27th.

The relation between safety and engineering and the engineer's place in the modern industrial world will constitute the motif of the entire program. C. P. Tolman, chairman, Manufacturing Committee, National Lead Co., and chairman of the Engineering Section, will preside.

The detail program follows:

Morning Session

10 a. m.—The Relation of Safety to Engineering Efficiency—L. A. DeBlois, manager, Safety Section, E. I. du Pont de Nemours & Co., Wilmington, Del.

Discussion opened by F. P. Sinn, assistant to the vice-president, New Jersey Zinc Company, New York City.

Safety Instruction in Engineering Colleges, "The University of Illinois Plan"—Paper by Bruce W. Benedict, manager of Shop Laboratories, University of Illinois.

How to Interest Student Engineers in Safety—Professor G. S. Blessing, Department of Engineering, Swarthmore College, Swarthmore, Pa.

Afternoon Session

2 p. m.— General subject: Safety Standards.

The Movement for Uniform Safety Standards and the Engineering Section's Part—David S. Beyer, vice-president and chief engineer, Liberty Mutual Insurance Co., Boston, Mass.

Round-Table Discussion of:

Proposed Standards for Guarding of Belts, Gears, and Other Power Transmission.

Statement of problem and opening of discussion by Thomas Stanion, manager of Safety and Sanitation Departments, Aluminum Manufacturers, Inc., Cleveland, Ohio.

Evening Dinner

Subject: The Engineer's Place in the Modern Industrial World.

David Van Schaack. Lew R. Palmer. H. W. Forster.

It is expected that there will be a very heavy demand for places at the evening dinner, which will be served in the Hotel Commodore at 7 p. m. at $4 a plate. It is essential that the officers of the section be informed of the number of places to be reserved. All who plan to present at this dinner are requested to send their reservations to the headquarters of the National Safety Council at Chicago before April 23.

The Betts Machine Company of Rochester, N.Y., are now building an all-geared head to be placed on their heavy-duty engine lathes. The construction is designed for belt or motor drive.

Steel Castings by Electric Furnace Process

The Fundamental Principle of the Electric Furnace, Together With Other Data, is Given. The Methods Adopted by One Firm in Turning Out Steel Castings by Electric Process is Also Described

By J. H. Moore

THE electric furnace as a means of melting scrap, while familiar to many, still remains a mystery to others, so that, before entering on the description of the plant of the Canada Electric Castings, Ltd., of Orillia, Canada, we will proceed to a brief talk on electric furnaces themselves.

The electric furnace is a metallurgical instrument in which any desired temperature up to the point of fusing of the best refractories obtainable can be attained and perfectly controlled. At these high temperatures chemical reactions take place more rapidly than in other processes, and the most refractory metals and alloys can be reduced to fluidity. The flexibility of the electric furnace also gives it a great advantage, and the superior quality of the product obtained is very marked.

Scrap containing valuable alloying metals, such as nickel, tungsten, chromium, vanadium, etc., can be melted without loss of these elements. Steel swarf and scrap, cast iron borings, etc., can readily be used in the electric furnace. The charge can be made up entirely of scrap and turnings. No expensive raw materials are necessary, with the exception that alloying metals can be added, if desired.

The steel from the furnace is finished off under a reducing atmosphere of carbon monoxide and a slag, out of which metallic oxides have been reduced. The steel is, therefore, free from gases and blow-holes when cast.

Generally speaking, an electric arc furnace for steel making consists of a steel tank, lined inside with certain refractory materials, and fitted with loading doors, and a tilting arrangement for pouring. Carbon or graphite electrodes of a suitable size are inserted through the roof of furnace, or, in some cases, the walls, and may be regulated either by hand or automatic control. Usually, both hand and automatic controls are used.

A high tension supply is brought into a transformer house adjoining the furnace and the power is brought down to a low pressure current for the operating of furnace.

The method by which the heat is introduced into the steel bath varies, and is dependent on the type of furnace. Each maker has his own particular method, so that, for our purpose, we will only describe the method employed by the firm whose plant we intend discussing. Before speaking of this, however, let us delve a little further into other points of interest in the electric steel casting process.

By the use of the electric furnace, steel of any composition made by other processes can be duplicated; but, in addition to this, steel which would be impossible by older methods is now obtainable. It is, no doubt, a well-known fact that this system has become an economical means of producing suitable electric steel castings. The electric furnace is a very rapid, accurate and clean method for producing any grade of steel. In any steel foundry, speed is specially important, for, with the heats coming so rapidly one after the other, a smaller furnace can be used than otherwise possible. This feature enables a foundry to produce their required tonnage with less floor space, equipment and a smaller set up of moulds. The steel can also be poured off more rapidly, so that there is less loss by miss-run and cold shut castings, in this way still further increasing the foundry's production.

It is also practical to superheat the steel to any degree desirable, without any hit or miss rule, so that small thin castings are commercially possible.

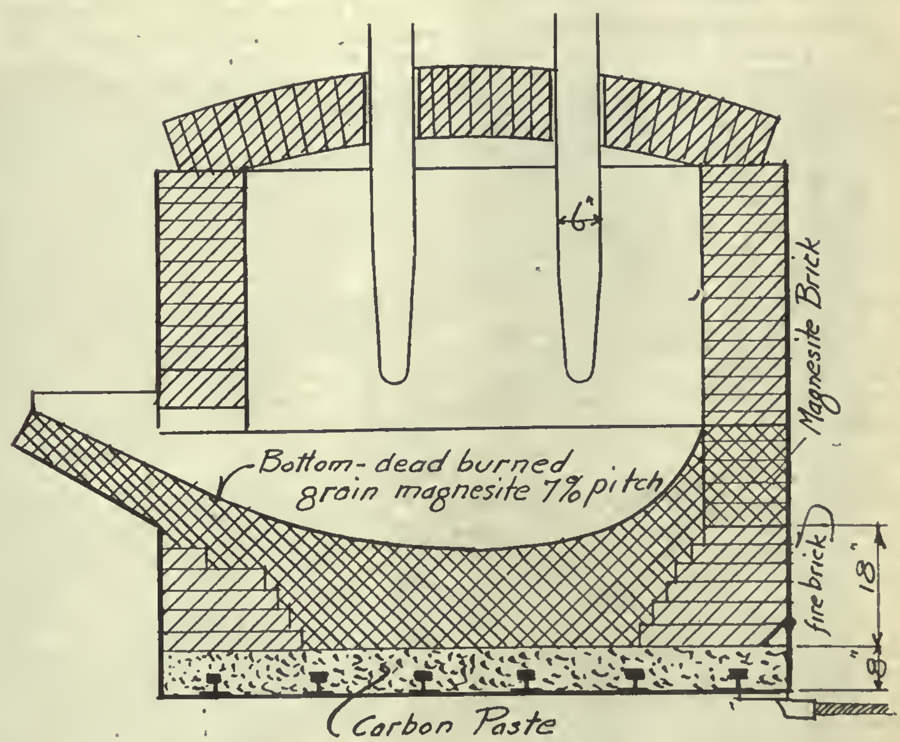
In the ordinary steel foundry making medium and light weight castings, the most favored size of furnace has a nominal capacity of 1½ tons per heat. In some cases, a 3-ton is used, but for average work, a 1½-ton will be found to be sufficient.

The Plant Itself

The Canada Electric Steel Castings Company have found the 1½-ton size ideal for their purpose, and to give readers an idea of the interior construction of this portion of the furnace we show the accompanying sketch.

The furnace was designed and built by themselves, and is what is known as a 1½-ton electric two-phase neutral bottom basic type. The two electrodes going through the roof are 6-inch Acheson graphite electrodes. The regular brickwork is of silica above the slag line, and magnesite is the basic lining used below. It will be noted that six steel rails form the bottom of the furnace, and that the neutral connection is attached to these rails. Carbon paste is rammed between the rails to a depth of 4½ inches. Next comes a further layer of carbon paste 3½ inches thick, after which a backing of silica brick arranged in the form shown was built up.

Into this form the magnesite and pitch was rammed. The magnesite was heated to about 100 degrees Centigrade, and the pitch, in molten state, was thoroughly mixed with the magnesite. The magnesite lining comes level with the pouring lip, as shown, and a magnesite wall is also built up slightly above the slag line. This wall is made 12 inches. The other details will be self-apparent from the sketch.



A SECTION THROUGH THE FURNACE.

The electrodes are controlled by 1½

h.p. shunt wound motors both automatic and hand controls being used. A graphic record is taken of the furnace at all hours.

The current enters the transformer house at 2,200 volts, and is brought and uses about 1,300 k.w.h. per ton of liquid metal, starting with cold scrap. The rate of heats vary, of course, on conditions and requirements.

The benefit of the furnace shown in the illustration is that it can be used for both desulphurizing and dephosphorizing, being a neutral basic bottom furnace.

With the electric furnace, steel castings of medium and light weight are made in the green sand moulds faced with silica sand, and gated very much like iron foundry practice. It is necessary, however, with any steel casting, to add sink heads, or feeders, to take care of the extra shrinkage. Apart from these few differences, the process of preparing the mould is similar to the iron foundry.

The concern we speak of handles all styles of steel castings. The writer saw in preparation parts for different types of machines, and the range of work possible is so varied as to practically defy classification. Enough to say that any castings which should be made of steel is what this firm caters to. Cylinder heads for gasoline engines, agricultural parts, miscellaneous machine parts, etc., etc., readily lend themselves to the use of steel in casting.

One job in particular that claimed the writer's attention was that of casting what is known as the Foley tractor wheel, for use on all styles of trucks. This wheel is somewhat of the same shape as any tractor wheel, and has the regular shaped treads, or grips, to aid the traction. It fastens on the regular wheel of the truck, but is so arranged that when the truck is running on normally hard ground the tractor wheel is clear of the ground, and only the tire is in running contact. Immediately the ground softens and the tired wheel sinks in the ground the tractor wheel takes over the work. Around this wheel is also placed a chain of the usual style adopted.

This tractor wheel, as can be understood, is made in different sizes, and its construction is such that it is especially difficult to mould. By the ordinary method of casting, it is questionable if as good a product could be obtained as by the electric furnace process. The strength of these wheels is the main consideration, so that the analysis of the metal must be perfect. This is where the electric furnace shines, for control of the metal is easily obtained by the electric process. It might be well to add that this firm takes a careful analysis of all metals produced, in order that they can be sure that only first-class material leaves their plant.

In discussing the future of the electric steel casting business with Mr. Lamble, the manager of this concern, we asked his opinion on the outlook for steel castings by the electric furnace process.

"If I say that we hope to enlarge our present premises in the near future, will that give you any idea of our viewpoint of the advancement of this field?" he replied. And we admitted that the reply answered our question admirably. When a firm starts enlarging its premises, they must have not only faith in, but definite knowledge of the future, of the steel casting business.

THE CANADIAN FAIRBANKS-MORSE CO., LTD., ENTERTAIN

The Ontario section of the American Society of Mechanical Engineers, together with various friends, were the guests of the Canadian Fairbanks-Morse Co., Ltd., at their plant on Bloor Street West, Toronto, Thursday, April 8.

The programme really consisted of three parts, the first being a trip through the various manufacturing departments of the concern. About 60 availed themselves of this opportunity, and special guides explained the various operations being performed throughout the plant. The work on the marine engines, and the type Z farm engines, occupied chief place in the limelight. CANADIAN MACHINERY saw so many real features of worth in this plant, that arrangements were made to present through our columns for readers' benefit some of the best of the machines, fixtures, etc.

After completing the tour of machine shop, foundry, pattern room, etc., the guests were brought up to the place they had really scented from afar, namely, the dining room.

This portion of the plant is a comparatively new departure, and will, after final completion, be one of the finest cafeterias, reading room, auditorium and club rooms combined, in any plant in the city. This club is going to be one of the big reasons why the Canadian Fairbanks-Morse employees will be one large harmonious crowd.

Dinner was served to about 100 hungry men, the additional 40 having arrived after work was through for the day. These extra roast beef assimilators were mostly foremen and executives throughout the plant.

The auditorium was next invaded, about 150 or more being present.

It was at this point that music reigned supreme, Mr. Musgrave and Mr. Harold Lloyd started a songfest, and songfest it was. Jolly song sheets with fifty-one choruses were issued, and just about this point the roof of the building raised at least an inch. Mr. Lloyd also rendered some solos, which were very acceptable.

Mr. Watkins, superintendent of the C. F. M., introduced Mr. B. P. Graves, designer of milling machines with the Brown and Sharpe Manufacturing Co., Providence, R.I., whom he stated was here to give an illustrated lecture on "Milling machine practice and design."

For the next hour and a half Mr. Graves talked milling machines in every shape and form. He discussed in detail the new taper nose spindle being equipped on the latest Brown and Sharpe machines, and explained in full why this style nose had been adopted. Various slides of very interesting nature were shown illustrating the different mechanisms in detail. The various type machines were taken up in sequence, and all the functions of the various levers were explained.

After the subject of the machines themselves had been thoroughly explained the question of proper cutters was gone into. Various slides made this subject very clear, and as Mr. Graves remarked, "Next to the machine itself the cutters are second in importance." The new type of coarse tooth cutter, as made by the Brown and Sharpe firm, was discussed and explained very thoroughly.

The third portion of the lecture was devoted to the use of proper milling fixtures. Numerous fixtures were shown in actual operation, and production figures were stated on other slides, illustrating clearly both the nature of the work and the possibilities of milling as a manufacturing operation.

If one were to attempt to pick out the most outstanding feature of the complete lecture, we believe the laurels would go to the new No. 21 automatic milling machine, which is being marketed by the Brown and Sharpe concern. This machine is entirely automatic in action and the production figures are both surprising and encouraging.

At a later date we hope not only to describe this new machine but to illustrate by photographs the various points of interest in its design. We also intend to present some of the fixtures which were shown at the lecture, so that readers have a treat in store for them.

Directly after the lecture everyone present was invited to fire questions at Mr. Graves, and they certainly took full advantage of the opportunity. The questions were, however, answered very promptly and satisfactorily.

To say the entire evening's entertainment was enjoyable is hardly strong enough. To our mind it was an evening long to be remembered by all taking part. It is very seldom so much real enjoyment and education can be assimilated in one evening.

PECULIAR ADVERTISING ERROR

In our April 8 issue, on page 11, there appeared an advertisement of the British Smelting and Refining Co., Ltd., that was an example of how easy it is to make a mistake.

This advertisement was never intended for CANADIAN MACHINERY, but for "Printer and Publisher." In some manner, however, it crept its way into our columns. Of course anyone reading the advertisement would at once notice the fact that it was not suitable for our paper, and therefore not sanctioned by the concern whose product it was advertising.

An Interesting Railway Ballast Cleaner

A MECHANICAL railway ballast cleaner, that eliminates the labor of from four to five men, has been developed by the Link-Belt Company. The machine is known as the Pratt ballast cleaner.

The device is operated by a small gasoline engine, mounted upon a steel frame. A bucket elevator takes up the ballast, elevates it to a shaking screen, through which the dirt passes to a tray beneath to be shovelled off by hand, and the cleaned ballast is automatically deposited in the "ditch" again.

In the early models of this machine, one of which is in operation on the main line of the Pennsylvania Railroad between Philadelphia and New York, it is moved forward by means of a hand ratchet at the rear. In later designs, now being developed, this ratchet will be harnessed to the engine, and the device will go forward under its own power.

One of these ballast cleaners, with five men, one of whom acts as a watchman on main line tracks, is said to do the work of ten men who formerly cleaned railway ballast entirely by hand. The early machines have been able to maintain a speed of one standard rail length of thirty-three feet every forty-five minutes. One energetic laborer, working ten hours, would require a whole day to cover the same distance. More efficient performance for the mechanical cleaner has been established. It is being tried out on the Baltimore & Ohio, the Central Railroad of New Jersey, the New York, New Haven & Hartford, the Western Maryland, and other roads besides the Pennsylvania.

Other mechanical ballast cleaners have been put forward by various inventors in the past, but according to the L. B. Co. none of them proved practical. One of their most vital weak points was the fact that they would not permit of easy train clearances when in operation in the inter-track space. This cleaner clears trains safely, and, when in operation on a single-track line, can readily be moved to make way for passing trains. On main line, or other double-track systems, the device rests on the ends of ties and finds its locomotion on caterpillars.

The cleaner is said to achieve a saving of $260 per mile on ballast cleaning. Dirty ballast retains water, which freezes in winter, causing rails to split from uneven pressure, and results in short-circuiting of block signals. When the dust pockets are removed, drainage is satisfactory.

The manufacturers of the ballast cleaner are also developing an auxiliary device, operated on the suction principle, which will take up particles of dirt and cinders to a depth of six inches below the surface of the ballast, once it has been treated by the mechanical cleaner.

THINGS WE SELDOM SEE

The man who will work without being watched.

A sales manager who doesn't think he pays the old man's salary.

A salesman who thinks perhaps the quality of the material may have something to do with his making those large contracts.

A stenographer who knows punctuation and will look in the dictionary when she is uncertain about the spelling of a word.

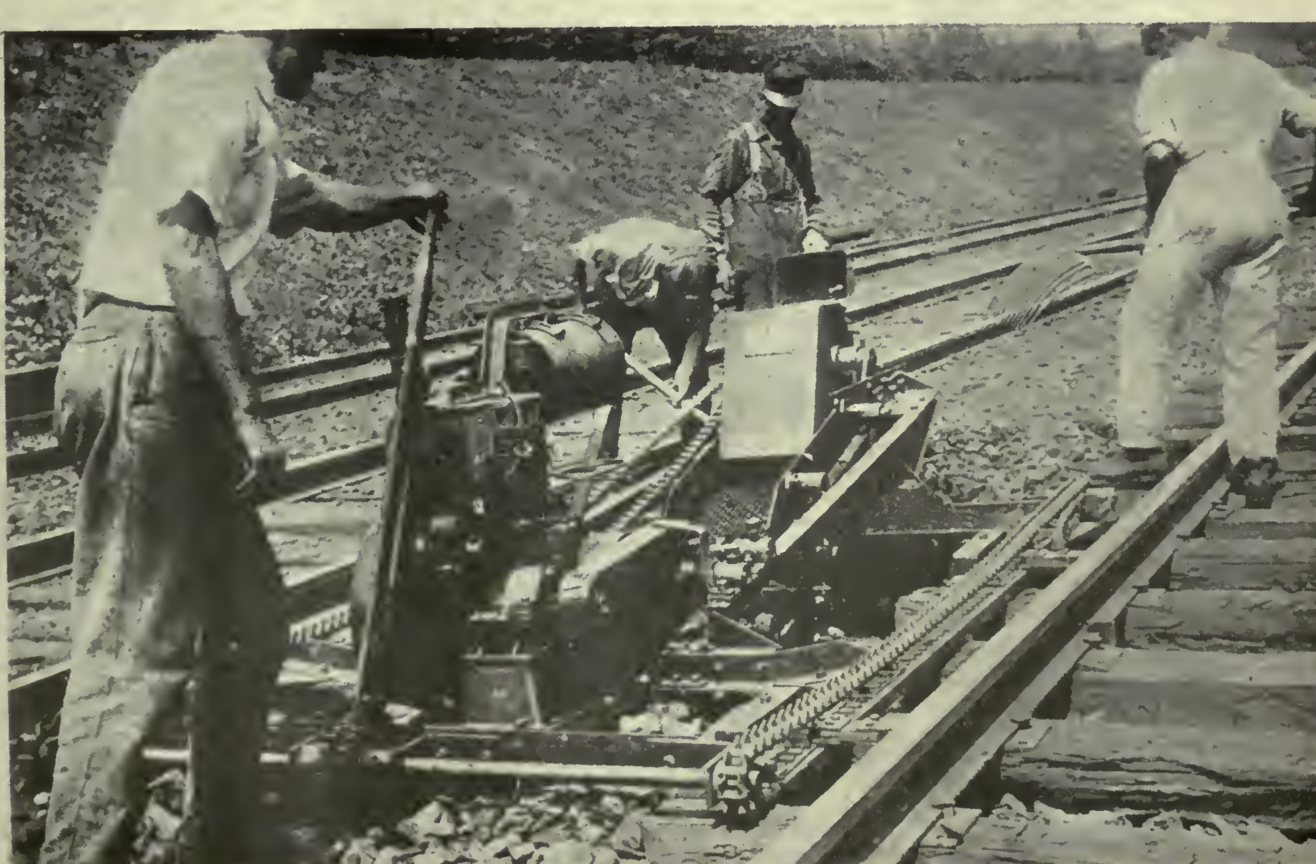
A purchasing agent who doesn't think he does you a favor when he asks you to quote.

A new superintendent who will wait a week before installing a much better system than his predecessor's.

A boss who acts as if he wasn't.

—"Exchange."

In every organization there are two kinds of men. Those who go ahead and do something and those who sit by and ask why the something wasn't done some other way.—"Quiterion."



THIS VIEW ILLUSTRATES THE CLEANER HARD AT WORK.

WHAT OUR READERS THINK AND DO

Is Accident Prevention an Art?

By EIWANTANO

It may seem strange to speak of accident prevention as an art, but in the writer's belief not only is it an art, but an extremely difficult one to master.

Success in organizing any accident prevention work, depends upon the personality of the safety engineer, upon the style of educational work conducted, and upon the interest which this work is able to arouse in the employees. No hard or fast rule of education work is possible, for such work should be adaptable to changing conditions. One point to be kept in mind, however, is this, that no matter what style of educative tactics are adopted they should be followed out as systematically as possible.

Take, for example, a firm who persist in plastering their factory with bulletin boards only, making no attempt to follow up with steps towards better working conditions. Such a plant is due for disappointments regarding the success of their safety venture. In reality their safety measure is merely a flash in the pan.

No matter what the scheme adopted, keep the old saying in mind, that a change is as good as a rest. When employees have been accustomed to any style of safety propaganda, their enthusiasm usually wanes. It is at this point that the safety engineer has a chance to display his ingenuity and personality.

The up-to-date engineer makes it his business to be familiar with the educational methods adopted by other companies, and can readily embody these ideas in a slightly different manner, thus changing his former tactics, and creating new enthusiasm. By following up the various safety conventions he can secure new ideas, and original methods of securing the interest of the employees.

But to get away from the position of the safety engineer and come down to rock bottom, suppose we were to ask the question, "What does the word Safety imply?" How many various styles of answers do you imagine we would receive?

Psychologists tell us that habits are formed through the paths of least resistance, etc., etc. Be that as it may, we will, no doubt, all agree on one point, that being the fact that safety can easily become a habit if we only allow our inclinations to lean in that direction.

A cautious person is very seldom injured, why? Simply because a cautious individual seldom invites danger, and avoids all unnecessary chances. Can you imagine a cautious person doing some reckless stunt? Of course not, for the very term cautious guards against such a possibility.

Let us consider the other extreme, those careless individuals, who will persist in taking chances. They usually meet with disaster, learning their lesson, in some instances, at a horrible cost, but nevertheless learning their lesson. In a great number of cases, this lesson changes their personality entirely, and makes them more cautious in future. In other words, they see the advantage of playing safe.

Of course, you will find the type of person who does not seem capable of learning a lesson, and keeps on in the careless, foolhardy way which leads to so much trouble, but this latter class is of the hopeless variety, and not worthy of comment.

To overcome the careless type of workman learning his lesson by accidents, the idea of safety educational work was brought into being. The benefits of this work need no praise, as results have proved its wonderful value. In many cases, where accidents were of daily occurrence, the accident toll has been brought down to one or two a year. This is no imaginative incident, for the writer personally knows of such a case where educative literature, combined with proper safeguards, accomplished this record.

From this example, it is plain to be seen that not only is suitable literature necessary, but proper safeguards as well. Wherever repetition work of any nature occurs, there is more than likely a chance of mental sluggishnes setting in. This condition is only natural, for the worker gets so accustomed to the operation that his or her movements become simply mechanical. If you are inclined to doubt this statement, place a guard over any machine, and let the worker become accustomed to the arrangement, then remove the guard and note how quickly an accident occurs.

Another point to be observed is the necessity of securing the co-operation of the employees, for without this feeling, no safety campaign can be the success it should be. This spirit is absolutely necessary to satisfactory results. First, the employer himself must show interest in the work, if he expects in turn to educate his staff to share a like enthusiasm. Each employee should be made to feel that he or she, as the case may be, is a cog in the wheel, and that without their help the machinery of safety cannot run smoothly.

Having pointed out these few necessary stipulations, let us consider some concrete examples, where safety bulletins, safety literature, safety guards, etc., have all in co-operative measure, accomplished results worth while.

Some Examples of Bulletins

At the Lackawanna Steel Co., Buffalo, N. Y., a large sized notice was placed in their drawing office, which read as follows: "Engineers and draftsmen, it is your duty to see that all plans and drawings for machinery, tracks and other equipment, provide for adequate guards,

The Use of Goggles

The subject of the proper use of goggles is one which has been threshed out in many ways, and the method adopted by the Illinois Steel Co. in this regard is well worthy of mention. Having considerable foreign labor at their plant it was considered advisable to use pictures as the best possible warning, so an illustrative chart, entitled, "He took a chance," was prepared.

The chart consisted of four photographs, each picture being accompanied with suitable wording. The first photograph portrayed a workman starting on a chipping job in the foundry, the foreman explaining to him his duties, also the necessity of wearing goggles.

The second photo illustrated, that in this case the workman decided he knew better than the foreman, so he merely fastened the goggles to the top of his hat and started work. Picture No. 3 illustrated the result, for the would-be smart worker received a nasty whack in the eye from a flying chip.

The fourth and last picture showed him coming out of the hospital all bandaged up, a sadder and a wiser man.

Bulletins of such nature have the punch and advantage of being easily understood by the foreign element, as well as by the native population, and as pictures of any nature send their message home, this chart spoken of proved itself well worth the time and trouble spent on its prepaartion.

The Use of Safety Literature

Regarding the different pamphlets issued on safety methods throughout the country, time spent in the reading of these will be found to be exceedingly profitable, for while some may not directly interest you, there is always embodied in these experiences, and talks, some germ of an idea which can be developed, and adapted to suit your own particular line of industry. It is only by an exchange of ideas and experiences that we can hope to further the cause of safety.

The Use of Safety Devices

In this the last portion of the present article we wish to emphasize the need of proper safety devices. The last few years have seen great changes in the safety field. Guards are now being placed on machinery where previously they were considered fads. Employers in general are realizing more and more the benefits to be derived from the proper protection of their machines. Modern lathes of all kinds, rolling mills, planers, etc., etc., are now being equipped with suitable safeguards, and existing models are likewise being protected at the dangerous points.

Notable amongst the various machine tools receiving protection is that of the power press. In the Nov. 6th issue, CANADIAN MACHINERY published an article on safety appliances as adopted to the power press, and in this article described and illustrated some twelve ideas in power press guards which had proved of special value.

As a portion of the article spoken of, we published a set of safety rules, two of which are well worth repeating. The first of these read as follows: "Do not operate a machine until you have been shown how to run it." The second was somewhat of the same nature: "Do not operate any machine in this factory until ordered to do so."

The latter rule is especially noteworthy, for unfortunately we always seem to meet in with the type of workmen who delights in monkeying with some other machine than his own.

As this article is not a detailed attempt to diagnose the accident problem, but rather a short but gentle reminder of the need of safety, and proper safety methods, we will conclude by quoting a very clever saying by "Power," as they see the accident prevention problems.

"The greatest factor operating toward the prevention of accidents is not the prevention device, but the prevention spirit."

Personally, the writer believes this statement to be absolute truth and of considerable value, for no prevention device can be a thorough success without the co-operation of the operator. He must first be infused with the prevention spirit. before we received his co-operation to make the device a success.

BOOK ON FORD CAR

The Norman W. Henley Publishing Co., 2 West 45th Street, New York, have published a revised and enlarged edition of their book on the Model T Ford car, its construction, operation and repair. This book also includes the Fordson farm tractor, the F. A. starting and lighting system, and the worm drive one-ton truck.

The author is Victor W. Page, M.E., author of "The Modern Gasoline Automobile" and other well-known volumes. The book has 410 pages and 153 specially made engravings. It is written especially for drivers and owners, and following are some of the most important contents: The Ford Car, Its Parts and Their Functions; The Engine and Auxiliary Groups; Details of the Chassis Parts; Driving and Maintenance; Overhauling and Repairing; The Ford Tractor, Operation and Maintenance and Repairing of Same.

These various headings give only a general idea of this book, as each of these headings are subdivided into detailed description of all parts, etc.

This volume has the benefit of being written by one who thoroughly understands his subject and is prepared in a way that all can understand it. The price is $1.50 and can be procured either through the publishers direct or by application to our regular book department.

LATEST CATALOGUE

The Brown and Sharpe Mfg. Co., Providence R.I., have issued their latest catalogue known as No. 137. This is really a revised catalogue as published previously by this concern, and covers their line of milling machines, grinding machines, automatic gear cutting, machines, screw machines, cutters, accurate test tools, machinist tools, etc.

A copy of this book will be sent to those interested. Merely write the head office and they will do the rest.

NEW CATALOGUE

The Cochrane-Bly Co., Rochester, N.Y., have issued a loose-leaf catalogue on their line of metal saw machines, saw sharpeners, filing machines, vertical millers, and vertical shapers. A copy will be sent to anyone interested who will write to their office at Rochester.

INTERESTING BOOKLET

The Silver Mfg. Co., Salem, Ohio, have issued an interesting booklet entitled: "Silver Drills in Service." It is out of the ordinary run of material and really tells a story of service of the Silver drills at the American sector of war. The tale is told by H. D. Parker, who was a First Lieutenant in the Ordnance Department, and we are told that a copy of this booklet will be forwarded to anyone interested.

Useful Information

TABLE OF WEIGHTS AND MEASURES

LONG MEASURE

12 Lines	1 Inch
12 Inches	1 Foot
4 Inches	1 Hand
3 Feet	1 Yard
6 Feet	1 Fathom
5½ Yards	1 Rod or Pole
40 Rods	1 Furlong
8 Furlongs	1 Mile
3 Miles	1 League
69½ Miles	1 Degree
1,760 yards or 5,280 feet	1 Mile
6,075.81 Feet	1 Nautical Mile

SQUARE OR LAND MEASURE

144 Square Inches	1 Sq. Foot
9 Square Feet	1 Sq. Yard
30¼ Yards	1 Sq. Rod
40 Poles or Rods	1 Rood
4 Roods	1 Acre
640 Acres	1 Sq. Mile

CUBIC OR SOLID MEASURE

1,728 Inches	1 Solid Foot
27 Feet	1 Solid Yard
42 Feet	1 Ton Shipping
128 Feet	1 Cord Wood

LAND SURVEY MEASURE

7.92 Inches	1 Link
100 Links	1 Chain
1 Chain	66 Feet
10 Square Chains	1 Acre

ENGLISH MONEY TABLE

4 Farthings	1 Penny
12 Pence	1 Shilling
20 Shillings	1 Pound

AVOIRDUPOIS WEIGHT

16 Drams	1 Ounce
16 Ounces	1 Pound
14 Pounds	1 Stone
25 Pounds	1 Quarter, C
28 Pounds	1 Quarter, E
4 Quarters	1 Hundredweight
20 Hundredweight	1 Ton
2,000 lbs., Can.	1 Ton
2,240 lbs., Eng.	1 Ton

PAPER

24 Sheets	1 Quire
20 Quires	1 Ream

APOTHECARIES' WEIGHT

20 Grains	1 Scruple
3 Scruples	1 Dram
8 Drams	1 Ounce
12 Ounces	1 Pound

TROY WEIGHT

24 Grains	1 Pennyweight
20 Pennyweights	1 Ounce
12 Ounces	1 Pound

CLOTH MEASURE

2¼ Inches	1 Nail
4 Nails	1 Quarter
3 Quarters	1 Flemish Ell
4 Quarters	1 Yard
5 Quarters	1 English Ell
6 Quarters	1 French Ell
37 Inches	1 Scotch Ell

MEASURE OF CAPACITY

4 Gills	1 Pint
2 Pints	1 Quart
4 Quarts	1 Gallon
9 Gallons	1 Firkin
36 Gallons	1 Barrel
63 Gallons	1 Hogshead

DRY MEASURE

2 Pints	1 Quart
4 Quarts	1 Gallon
2 Gallons	1 Peck
4 Pecks	1 Bushel
36 Bushels	1 Chaldron

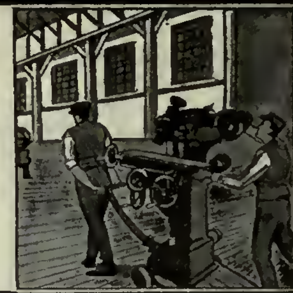
TIME MEASURE

60 Seconds	1 Minute
60 Minutes	1 Hour
24 Hours	1 Day
7 Days	1 Week
4 Weeks	1 Month
12 Months, or 365¼ Days	1 Year
100 Years	1 Century

DAYS IN THE MONTH

30 days hath September,
April, June and November;
February has 28 alone,
And all the rest have 31;
But Leap Year coming once in four,
February then has one day more.

DEVELOPMENTS IN SHOP EQUIPMENT



KEMPSMITH NO. 4 VERTICAL MAXIMILLER

In many instances the vertical type miller has many advantages over that of the horizontal type. With this in mind the Kempsmith Mfg. Co. has designed the No. 4 vertical maximiller, which embodies several of the features of the No. 4 plain horizontal maximiller, which was placed on the market some sixteen months ago. This maximiller has been designed in recognition of a great demand for a heavy, powerful, conveniently-operated machine that will produce accurate work rapidly.

Much thought and study has been given to such features of design as rigidity, weight, accurate and rapid production, etc.

Only the best materials have been used in its manufacture. Gears used throughout this miller have to pass certain stringent chemical tests before being used, and then are scientifically heat treated for the particular use to which they are to be put. All shafts, especially those in the speed train, which are subject to much strain, are of heat-treated alloy steel.

The main frame members of the machine, including column, knee, saddle and table are of semi-steel. This machine has been carefully designed to give it maximum strength without adding on metal merely to make a heavy machine. Every working part is well proportioned. A large base has been provided which insures stability for the entire machine.

The Knee

The design of the knee is the same as that used on their No. 4 horizontal maximiller, having no openings in the top whatsoever, merely a shallow depression to receive the centre-drive cross-feed screw. The side walls also are practically solid, having but three small openings. This solid construction of course serves to resist clamping strains and the torsional effect of the table overhang. The location of the cross-feed screw in the shallow depression in the top of the knee at the exact centre insures the greatest possible strength and accuracy as the pull is applied directly to the centre of the saddle.

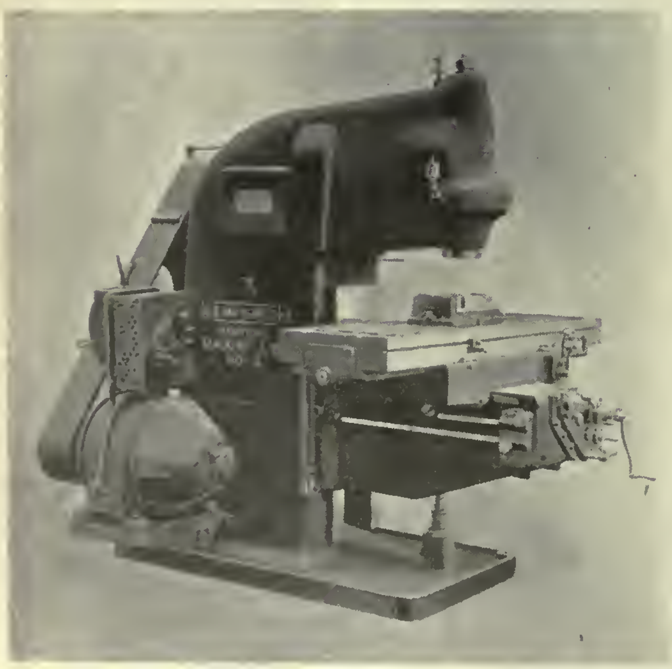
The column has very few and small openings, is well ribbed and has a rib midway of the column height, forming a reservoir for the speed drive oil. This also has a great stiffening effect on the column.

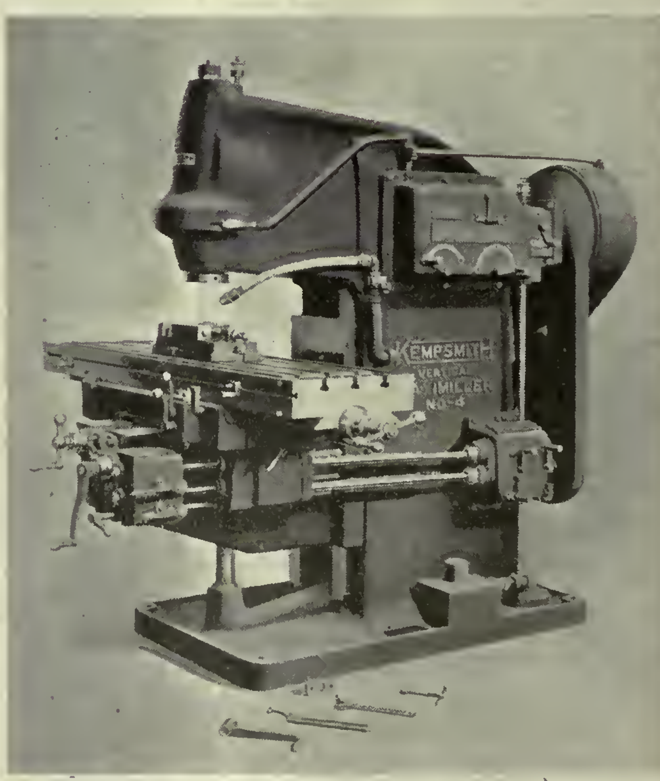
Knee, Table and Saddle

The knee, table and saddle are counterweighted by means of weights inside the column. This provides easy, vertical adjustment of work in relation to the cutter, and makes it unnecessary to have the usual auxiliary vertical slide for the spindle.

The table has a working surface of 70 inches by 18 inches and a longitudinal range of 42 inches. The table gib is of the adjustable taper type with locked adjustment. Unit construction is well recognized because of the easy repair facilities and this has been carried out to the fullest extent in the design of this machine.

The spindle nose is of the Kempsmith patented type; is hardened, and provides for driving face milling cutters in either direction and permits cutter to be quickly and easily removed.





WORKING SURFACE—70"x18"; T-Slots, three ¾". RANGE—Longitudinal, Power, 42"; Transverse, Power, 14"; Vertical, Power, 20"; Nose of Spindle to table in lowest position, 22"; Throat distance, 19". SPINDLE—Taper hole, B. & S., No. 12; Hole through, diameter, 1⅛"; Spindle speeds, number, 18; Spindle speeds, range, 14-355. DRIVING PULLEY—Diameter, 16-¾"; Belt, width, 6"; Pulley speed, R.P.M., 400. FEED—Number of feeds, 18; Range, inches per minute, ⅝" to 25". POWER QUICK TRAVERSE—Rate, longitudinal, inches per minute, 100; Rate, traverse or vertical, inches, 36. FLOOR SPACE—In direction of spindle, 99"; in direction of table travel, 122". SHIPPING DATA—Net weight, 11,050 lbs.; Shipping weight, domestic, 11,800 lbs.; Shipping weight, foreign, 11,075 lbs.

The slow-speed shafts in the spindle train are extremely large and of heat-treated alloy steel. The bevel gears are very large and of coarse pitch and of the spiral bevel type, giving a smooth, silent drive. Extreme rigidity and driving power can be obtained since the usual auxiliary slide for raising and lowering the spindle has been eliminated.

The right-hand design has been used as this is the normal direction of the spindle rotation for standard drills and boring tools. A spindle reverse has been incorporated for the reason that in order to get cutting strains in proper direction on gibs and tables a face mill must be run in the opposite direction to a spiral or slab mill. To reverse the spindle it is merely necessary to throw a small lever a distance of about three inches. The hand lever shown in the front of the machine operates the clutch, which is of the friction plate type. Large diameter friction surfaces are forced together by a combination toggle and plain lever movement which gives the required pressure on the plates with very little effort on the operating handle. It is easily accessible for adjustment for wear. The momentum of the spindle is instantly overcome by means of a brake operating on the reverse throw of the clutch lever.

The driving pulley is 16¾ in. in diameter. It takes a 6-inch double belt and runs at 400 r.p.m. The drive pulley is mounted on ball bearings, and with the clutch is enclosed in a protective housing.

Power Quick Traverse

This machine is arranged with power quick traverse, giving 100 in. per minute travel of the table in either direction and 36 in. per minute on the vertical movement and the transverse movement. The control of these various movements is concentrated and it is unnecessary for the operator to change his position in operating all the quick traverse and feed movements. In case of error on part of the operator engaging wrong levers no harm can come to the mechanism as safety devices are incorporated. Two levers control the longitudinal feed and quick traverse. Operator merely pushes the one required in the direction he wishes the table to travel. The knee and saddle are controlled by a second set of two levers. The unit which shall move is determined by push pins located in close proximity to the respective hand-feed handles.

Lubrication

Much thought has been given to the perfect lubrication of all working parts of this machine. The gears and bearings in the entire speed and feed mechanism run constantly in oil and are lubricated by splash. The balance of the oiling system is centralized at two points, which makes it certain that none will be overlooked.

A pump with about 15 gallons capacity per minute is built into the machine. It is of the centrifugal type and can be disengaged if the nature of the work does not require a cooling fluid.

The spindle is very large in diameter. It is of alloy steel with the front end hardened so as to give a hardened front bearing and spindle nose. It runs in phosphor bronze bearings, which are easily adjustable to compensate for wear. All other shafts in the speed transmission run on ball bearings. The spindle has a No. 12 B. & S. taper hole and the hole through the spindle is 1⅛ in. in diameter. Eighteen spindle speeds are provided, giving a range of from 14/355.

Eight changes of feed are provided ranging from ⅝ in. to 25 inches per minute in geometrical progression. The gears are all heat-treated steel and run constantly in an oil bath. Proper safety devices are incorporated which will slip before a destructive load comes on the feed drive, but takes up its driving function again without attention as soon as the load drops to safe limits.

The change in the power quick traverse rate does not effect the speed rate of the cross and vertical movements, these remaining the same for all movements.

The quick traverse is available even if the spindle and feed are not operating, which is a particular advantage in setting up the machine or in returning the table after completing a cut. The drive may be interrupted at the drive pulley in case the machine is not in use. Oiling directions for this machine are very simple and complete. A small brass plate located on the speed box is all that is necessary to explain their operation to new or unskilled operators.

This machine is regularly arranged for single pulley drive but can be arranged for motor drive through belt, in which case the motor recommended is of 15 h.p., running at 1,200 r.p.m.

NEW THINGS IN MACHINE TOOLS

The Grand Rapids Machine Company are now manufacturing a line of tap-grinding machine for grinding the taper and the clearance on the ends of taps.

The Badger Tool Company of Beloit, Wis., are now making a new line of grinding machine, known as the No. 4. The spindle is fitted with both radial and thrust ball-bearings.

A new compression coupling, for use on shafts between 15-16 and 3 inches in diameter, has been placed on the market by the Cincinnati Ball Crank Company of Cincinnati, Ohio.

The Streine Tool and Manufacturing Company of New Bremen, Ohio, have recently brought out a new toggle forming press for roofing and special shapes, with a capacity up to 12 feet in length. It is also provided with tables for die work.

An interesting spiral fluted taper reamer, that may be used in drilling machines, is now being made by the Gammons-Holman Company of Manchester, Conn. They work rapid and cut freely, the chips resembling fine wool. These reamers are made in all the standard sizes.

The Lapoint Machine Tool Company of Hudson, Mass., have added a new type of broaching machine to their regular lines, which will be known as the No. 3 Duplex. The power screws may be operated jointly or as separate units as desired, and to any required length of broach.

The latest improvement in the 8-inch Hercules gear-hobbing machine, made by the Hercules Machine and Tool Company, of Astoria, N.Y., provides for exhaust adjustment in the centering of the hob. Automatic stops are provided for disengaging the feeds when machining the various classes of gears.

A special design of portable grinding machine, manufactured by the Mummert-Dixon Company of Hanover, Pa., has some very interesting features. The machine is self-contained and the wheel may be operated at any desired angle without interfering with the feneral alignment. Ball-bearing parts assure easy movement.

What has been turned a short-cut lathe has been placed on the market by the O. R. Adams Manufacturing Company of Rochester, N.Y. The headstock is designed to give six changes of speed, with a range from 43 to 375 r.p.m. Speed changes can be made while the lathe is in operation. The spindle is prevented from turning when in a neutral position by the action of a brake.

A two-motor, high-power radial drilling machine, of the Ryerson-Conradson type, is the latest product of the Jos. T. Ryerson and Son Company of Chicago, Ill. These drilling machines are made in sizes of 4, 5, and 6 feet arms. The principal feature in the design is the small number of shafts and gears used, there being only four shafts and sixteen gears in the machine. S. K. F. ball bearings are fitted in the head. The spindle drive is obtained from a vertical reversible motor, direct connected to the drive shaft by a self-aligning coupling. An independent vertical motor is used for raising and lowering the arm.

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PRINCIPAL CONTENTS

The Steel Market

ONE of the topics discussed in the purchasing circles just now is: "When will there be a uniform steel market?" By that we mean, when will there be a price for bars, plate, sheets, shapes, etc., that will be within reasonable distance of uniformity at various points, and from various concerns?

Right now it is proper to state that there is no price in the steel market in this country for available material that can be counted upon as standard or uniform. There may be one or two minor exceptions to this statement, but those who are buying steel will admit that it is not far wide of the mark.

There is the price that the Steel Corporation is asking. It is, to all intents and purposes, the price that was set by the War Board on March 21 of last year. The drawback, of course, is that the Steel Corporation is not able to make deliveries on account of the large tonnage already on its books. Canadian steel makers are dependent for many of their materials on U.S. sources, and they have felt the prevailing high prices and the exchange rates as well.

The independents and the premium mills of the States have another set of prices. The brokers and the jobbers have a brand new schedule, depending very much on the conditions governing each sale.

Canadian jobbers are called upon to keep on increasing the amount they have to invest to finance the handling of a given tonnage. On their turnover they do not make a correspondingly high profit. They are doing business with the same customers they have served in the past, and expect to keep on serving in the future, and they feel in duty bound to secure material for them at as close a figure as possible.

But there is in the situation now less certainty than ever. The scarcity that has been the dominating feature for some time is acute. It is not being overtaken despite the large production of U.S. mills, for the good reason that they are working against bookings that are 130 per cent. greater than capacity.

It may be an uneven and irregular market for months to come. Conditions that might help in smoothing out trouble are not coming to pass, but in their stead we have the added complications of transportation strikes by a group of industrial rebels whose chief aim seems to be the making of intolerable conditions for all rather than bringing about better terms for themselves.

Why the Strike Talk?

STRIKE talk is having its innings in Canada at present, and from past experience it would not be surprising were the strike talk to culminate in strike action.

A workman sees the price of everything he buys going week after week past and beyond his buying power. There are many cases where increased effort on his part would bring increased reward. This is not a blind statement, for there are plenty of records that can be drawn upon to show that in spite of increases in wages, production is less than in former years.

There are other cases, and many of them, where a workman is powerless to increase his income. Increased effort on his part would simply mean increased profit for the firm.

The man who is powerless to increase his income, and whose income is not sufficient to allow him to provide decently for his home and children, has good reason to talk strike.

He sees no other way out. His strike pay will mean added misery, because it is woefully inadequate.

The greatest rebuff that strike talk can get will come when prices cease to rise overnight.

The rising market is getting under the skin of the employer, and it is making the going mighty hard for the man in the shop.

There are increases in costs that are warranted, and can be accounted for. There are increases in costs that are simply cases of personified greed running mad.

One group of employers is forced to keep on paying higher and higher wages in order that the greed of another class may be gratified.

The business of explaining "I am not a profiteer" is being reduced to such a science that it is well nigh impossible to drive the original "gouge 'em" group into a corner and secure them, and thus save the world from their further operation.

We have drifted and skidded and slid into a period of greed, where the finer instincts of kindness and consideration for others are dulled, forgotten or utterly disregarded.

In such a period—and we are certainly in it to the neck—heaven help the man who finds that he cannot increase his earning powers to the point where he can live decently and keep his home in comfort!

And in that same time, pity the firm whose pay-roll is decorated by a long list of men who have separately or collectively decided that they will keep production down to the lowest possible point, and drive wages as far in the opposite direction as possible.

The present situation needs a heap more common sense than we have been exhibiting lately, if we hope to get over the top of it in safety. The fool agitator and the "beat them" employer should back off the map in a good many cases, and when off, stay off for good.

IT IS just a question whether a settlement should be made with the present strikers on the U.S. railroads. When a man has a mad dog to deal with he doesn't negotiate. He travels to the woodshed for the axe and he travels fast, too.

YOU can't blame Mr. Galvanized Sheet for being a bit stiff and chesty as he passes out of stock at 12 cents per pound.

Assassinating Arithmetic

THE Technical School is recognized to-day as one of the wisest provisions a country can make for the education of its youth, yet at times some seeker after notoriety, or perhaps some well-meaning, if misguided, enthusiast, recommends some radical change in the public school curricula which would have the effect of undoing the good of the technical school and leaving the majority of the rising generation without a proper foundation for earning their livelihood.

One such has recently made a statement to the effect that arithmetic should be, perhaps not altogether eliminated, but rendered quite innocuous so far as the public school pupil is concerned. He would eliminate complex fractions, recurring decimals, trains meeting and passing each other, boats going up and down stream, and true discount. While highly pleasing to the youth of the land, and while allowing time for more diverting and entertaining subjects such as sculpture, music and the higher aesthetic attainments, any curtailment of the mathematical subjects mentioned could only be looked upon with apprehension.

Rather should arithmetic, and that other somewhat prosaic subject, grammar, be extended, and made to occupy more of the student's time in the public school. The true function of education is to prepare a man for his life's work and to enable him to profit by the experience or literary genius of others, and when the first of these is lost sight of it avails nothing that he be able to play the fiddle or enjoy himself otherwise if he is unable to earn his daily bread.

As a preliminary to a machine shop apprenticeship or a course of study in any one of the branches of the engineering profession, mathematics is essential, and the more knowledge of this nature a boy can assimilate in the public school, often his only chance, the better equipped he will be for his further training.

After all, the public school, high school and university are only the beginning of a man's real education, and the earlier he stops school attendance the more essential it is that he be given the most necessary and immediately useful knowledge.

A MAN is coming all the way from London, England, to go over Niagara Falls in a barrel. The high cost of carbolic acid has driven folks to do many strange things.

THE KAISER was blamed for the war. Said Kaiser has been wearing wooden shoes and chopping trees in Holland for some months, but still there is a very respectable war story coming through from some corner of Europe, or Asia, or Ireland every day.

THEY do tell that X-ray photos of prospective brides' and grooms' diaphragms give a true test as to the suitability of the marriage. An X-ray of the groom's wad also gives a good indication of his ability to stand the racket.

PEOPLE in the Southern States are starting to deck themselves in blue overalls in order to combat the high cost of clothing. And so overalls 'opped from $2 to $6 per pair. The man who can swat Old Man Hicost right on the jaw has not yet arisen in the land.

THE RIVERS of Alaska are in danger of being robbed of their greatest asset, salmon, because no thought is given to re-stocking the streams. The timber limits of Canada are in danger of being sadly depleted of pulpwood because no good policy of reforestation is generally used. It is an easy thing to hand down a depleted heritage to coming generations.

Resuming an Old Fashion

THOSE who are wont to bemoan the departure of all that is beautiful from the world, with the advent of highly specialized industry, may take fresh hope. In the marine world, where progress follows progress in bewildering fashion, there has suddenly arisen a champion of what at first sight would seem reaction. This gentleman claims that future ships should be built with a receding stem, instead of the straight stem so much in use now.

Those lovers of beauty who used to pause to admire the exquisitely curved stem, finished off, as it usually was, with a more or less artistic figurehead, will claim the defender of the curved stem as one of themselves. It is not in the interests of beauty, though, that the receding stem is being advocated, but in the interests of safety. Both life and property will be much more secure if, in the event of collision, the striking vessel possesses a receding stem instead of a straight one. As most dangerous collisions are end-on ones, where the colliding ship usually strikes the victim on the broadside, the effect of the straight stem is to do as much damage below the water line as above it, the blow taking place along the full height of the stem. With the curved or receding stem, the blow takes effect at first high up on the ship's side, and before the damage can extend downwards the stem has to force its way through decks and frames. The force of the blow is thus absorbed much before the damage can reach a point on the water line or below it, and instead of the collision resulting in the sinking of the ship in a few minutes, there is very little chance of the vessel sinking at all.

There is at least one firm of shipowners who are building their stems on these lines, notwithstanding the fact that by so doing they have to pay larger dockage rates, owing to the extra space occupied by the overhanging stem. The safety feature of this type of construction so much appeals to them that they cheerfully stand the added expense. It is the desire of a good many people, that this form of stem be made compulsory, and a much greater degree of safety attained thereby.

AGAIN this year, with the approach of May 1, it appears that the laborer considers he is worthy of his higher.

MARKET DEVELOPMENTS

Increases Not Reflected in Canada Yet

Greater Tonnage Turned Out Not Reaching the Consumer Here—No Cancellation of Orders is Again Being Brought to Attention of the Customers in Tool Market

CANADIAN consumers of steel read with some interest of increases claimed by the United States mills month after month, but it is a fact that they find it hard to see where there is any of this improvement reflected in the shipments that are coming to Canada. Production was 84% in January, 90% in February and 96% in March, but against these figures there is a booking of some 126 per cent. of capacity. The market in this country is being supplied with a fairly large tonnage of premium goods. Jobbers find it necessary to put in much larger amounts of money to finance a given tonnage, and they do not make a correspondingly high return.

One of the Toronto dealers made the point this week that the old theory about steel being the barometer for all other things had been shot to pieces. "Steel prices at the close of the war were kept down, and it was a long time before the schedule of March 21, 1919, was departed from, but the comparatively low price of steel did not prevent in the slightest degree the price of everything else running away."

Some signs of more caution are noticed in the machine tool market, where some dealers are again calling attention to the fact that they are accepting business without the cancellation allowance. When a customer places an order they regard it as absolute, and deny him the privilege of changing his mind or switching his business.

There are rumors of an increase coming in high-speed drills. The present list has been in existence for some months now. Nothing official has come to the dealers of the reported increase.

The scrap market is dull and listless, but prices are still standing where they were chalked up to several weeks ago.

MONTREAL CAN SEE NOTHING IN THE WAY OF LOWER PRICES

Special to CANADIAN MACHINERY.

MONTREAL, April 15.—While some dealers here are looking forward to better conditions in the early future, as regards delivery of material, few of them anticipate any easing of prices as a direct consequence to greater production and supply. The fact that wages in all lines of industry are of a very high character and the prospects of further demands by some trades on the first of May, gives little hope of relief in the way of lower prices on any line of commodity. In the States this condition of high cost of production is an important factor in the problem of trade development. There is little, at present, to show that the demand for supplies has been seriously affected by the steadily advancing prices, but there is an undoubted tendency to favor British product that apparently is becoming more plentiful on the Canadian market. An interesting feature of present trading is the assurance of dealers representing British manufacturers of prompt shipment of orders for material or equipment.

Despite the announcement that steel mills in the States have been steadily increasing production, the difficulty of dealers in obtaining supplies for their customers seems as great as ever, and it is seldom that full requirements for steel commodities can be satisfied. The situation to-day hardly permits the dealer to quote a definite price on any of the lines that are hard to obtain, owing to the uncertainty that dominates the trade at the present time.

Warehouses in this district are not overcrowded, and while dealers are anxious to supply the needs of their customers, they are in no hurry to stock up heavily at existing prices; not that they look for lower figures, but the high rate that has prevailed on exchange has not been conducive to the carrying of unsold material.

Delivery Still a Factor

The sameness that appears to mark the trading in machine tool circles offers little opportunity to tell of any new developments in the market. The higher costs that are the result of increased wage grants in nearly every line of activity is likewise reflected in machine tools, and manufacturers seldom have to announce a price lower than that previously quoted. On the contrary, quotations are generally of a higher order than the one before. The lower exchange has given some relief to the American trade, and buying in this direction is on a freer scale, but delivery is not all that could be hoped for, with the result that trading in used machinery, when such can be had, is still of considerable volume.

Hard to Get Supplies

There is little that is new in the old material situation, and dealers report a quiet week with less than a normal movement of scrap. The non-ferrous lines have shown a tendency to weaken but dealers show little inclination to alter present quotations, which they claim are a fair average of the figures at which sales are made. Dealers have no difficulty in disposing of steel scraps, particularly in the way of cast iron, the need for which is as pressing as ever; the great trouble appears to be the accumulation of sufficient material to meet the daily needs of the foundries and furnaces. Prices here are unchanged, and may be taken as a normal quotation rather than the actual figure at which a sale would be made as prices are invariably made on the merits of each individual case.

CAN'T MAKE MUCH ON PREMIUM STUFF

Markets Uncertain in Many Lines, But Big Volume of Orders Are In

Toronto, April 15.—As long as the trade has the spectacle of seeing the various industries out in the market bidding for material that the steel mills can turn out, we are going to have fairly high prices. Selling is not yet a problem in the market. It is yet a matter of production more than anything else.

And yet there are indications that some of the companies consider that the limit of prices is here. For instance, it is hard to account for the fact that some of the dealers are refusing now to accept business that has a cancellation clause attached to it. When the order is placed for the equipment, it is regarded as a binding and absolute order, and it is hard to name anything that is considered as sufficient grounds for the breaking of the contract so made.

There are other lines on which contracts are given now, in which the price is given up to a certain date, after which the selling company retains the right to increase the price, but puts a limit on the increase that can be made over the quotations given in the first place. Buyers will feel more assurance under such a plan than where they have no hold whatever in the matter of price increases. Several indications are coming to the surface that indicate a feeling of caution, and a desire for more assurance when placing business for the future.

There were several fairly large propositions in sight in this district, but latest reports indicate that some of them may be held over, the promoters feeling that the time for making large purchases is not very opportune, and they hesitate also to go into the labor market at this time, hoping for something better later on. It cannot be claimed, though, that firms are to any great degree thinking of holding back for the reason above stated.

In Small Tools

Dealers report a good volume of business in small tools and supplies generally. One hears reports again of some price shading that has taken place. This time, the line was carbon cutters, and the quotations on these have been, in one or two cases during the last week or so, let down about ten per cent. There was almost an entire absence of this for some days on all lines, nor can it be said that the practice is by any means general now. It may be quite an isolated case that was reported to CANADIAN MACHINERY this week, but nevertheless it was a bona fide case.

There is also a report that one hears in several places to the effect that high speed drills are due for an increase in price. The prices that are prevailing now have been standing for about four months. The dealers have not received word of an advance, but CANADIAN MACHINERY has information that it considers reliable to the effect that an increase is almost certain to be made in high speed drills in the near future.

POINTS IN WEEK'S MARKETING NOTES

Pittsburgh reports large increases in production of steel, but Canadian buyers fail to see any change in deliveries at their shops.

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There has been no great inconvenience here yet following the U.S. railroad strike, but the trade believes the real trouble will come after they settle the trouble and try to straighten matters out.

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Several of the steel dealers from this district are again in the U. S. steel field seeing if they can get any better service in the way of deliveries.

—

Warehousing interests here find that they have to put up an increasingly large amount of money each time to finance the buying of premium goods, and they are not getting a correspondingly large margin of profit.

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Some of the machine tool houses are calling attention again to the fact that the no-cancellation clause in business placed with them is to be enforced.

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Although nothing has come to the dealers here officially, there is a report in circulation that an increase may be announced in the price of high speed drills.

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Trade continues dull and uninteresting in the scrap metal market. Coppers are unexplainably weak, while there is not sufficient quantities of iron and steel coming in to create any interest.

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Unsettled conditions in the labor market and high costs connected with installations are causing some projects to be held up in the meantime.

Many Theories Exploded

The past few months have shot old theories to pieces. Among them is the one that steel is the barometer of the market. This was always accepted with as much solemnity as the deductions gathered from the volume of shipping that was being done by the Old Country. We used to believe that if steel prices broke, all was off, and that if they stayed strong, all would do likewise. The steel prices for a long time were held at the March 21 schedule. By this document they were forced down from their war level, and they stayed down for some time. In fact, the U. S. Steel Corporation insists on still keeping them down. But it has not affected other things in the market, and now that premium mills are operating to the fullest extent, no difference is noticed. It looks as though we would have to get out a new set of "Sure Things in Business."

Dealers do not see anything in the near future that is going to bring about a much-desired levelling of prices in the steel trade. By that we mean a condition where a ton of steel plate, or a ton of sheets can be said to be worth a certain definite sum. Just now such a figure cannot be given. In prices it is simply a case of paying for the material and the delivery.

"One man's guess is as good as another as to the future," is the way one Toronto warehouse sized up the situation this morning. Some of the men who have been regarded as leaders in the steel market have had a long string of poor guesses to their credit during the past few months. It is a great time for any person to wreck their reputation in the prophesying business as to what will take place a few months from now."

Sheets are getting no better in regard to the way they are coming in here. Some of the local warehouses have boiler tubes now in from 2 in. to 4 in. sizes. Against the rather small arrivals, there are orders from all over the country. Blue annealed are coming here in large lots now, but it is premium material, and prices are high. Warehouses find it none too easy to get their money back as readily as in normal times. One of the warehouse men stated the case this way: "We are constantly called upon to increase our investment. In almost every case now we have to put up more money to get anything approaching the same tonnage as we have handled before on much smaller amounts. It is impossible to keep the margin of profit up to the amount of increased capital that one must keep employed in the business. Dealers take on premium business because the trade here simply has to be kept supplied, and there is no other way to get the goods with which to do it. A jobber takes a chance when he goes into the market now and buys up three or four hundred tons of sheets at the premium price. Were they to sag in price, who would come to his rescue? It is a fact that dealers are not making as much money on high-priced premium goods as they do in the ordinary way at a much lower figure."

Several Toronto men are in the steel section of United States now. They have been through the territory for some days trying to get a greater tonnage for their customers here.

The railroad strike would be felt in the warehouse business about as soon as any place, but no complaint is made here yet. "Our experience with railroad strikes," commented one dealer, "has been that the trouble starts to come about the time the thing is settled. Then it is that we begin to find out that whole carloads have been lost. It would not take much to upset the transportation business at this time. If the strikes keeps up we will feel it all right, but fortunately we have nothing extra to complain of so far."

The scrap market is weak, although

not enough so to make prices drop. The schedule remains as it has been for the past month. Coppers are weak. There is no very apparent reason why this should be so. The iron and steel section of the trade is also dull, largely from the reason that there is little or nothing coming in. Material is badly wanted. This is shown in several ways, one of them being that many foundries are advertising in papers in their own localities stating that there are in the market for scrap material. In this way there is no doubt that a certain amount of the material is being kept from coming to the larger scrap yards.

STEEL MILLS CLAIM THAT THE PRODUCTION IS GAINING NOW

Special to CANADIAN MACHINERY.

PITTSBURGH, April 15.—The United States Steel Corporation reports unfilled obligations at the close of business in March at 9,892,075 tons, showing an increase during March of 389,994 tons, against increases of 216,640 tons in February and 1,020,075 tons in January. In many quarters in the trade the expectation had been that March would show little, if any, increase, chiefly on the ground that the corporation was already well sold up and would hardly continue indefinitely to sell each month a larger tonnage than it shipped. It was also thought that when the customers of independent producers were buying very little, even the corporation customers might be unwilling to make extensive commitments despite the fact that the corporation's prices are well below those of any of the independents, since the corporation continues to adhere strictly to the Industrial Board price schedule of March 21, 1919. Thus the March increase of 389,994 tons, equal to 28 per cent. of capacity for the month, furnishes surprises in most quarters.

The corporation's shipments during March may be estimated at about 96 per cent. of capacity, against about 90 per cent. for February and about 84 per cent. for January. With shipments at 96 per cent. of capacity and bookings in excess of shipments by 28 per cent., the bookings would be about 124 per cent. of capacity. The excess of bookings is the more remarkable in view of the fact that one subsidiary, the American Sheet & Tin Plate Company, was practically out of the market in March, having opened its books for the present half year last November, and not having yet opened its books for the second half until this week.

Sheet and Tin Plate Market Opened

By booking orders and contracts each month far in excess of the shipment, the corporation gives evidence each month of its purpose to adhere indefinitely to the Industrial Board price schedule, even though the independents all insist upon higher prices, and secure the higher prices on all the tonnage they sell. Another evidence that there is no disposition to depart from the policy is furnished by the American Sheet & Tin Plate Company this week opening its order books for the new period at the Industrial Board prices it has previously held to: Blue annealed sheets, 10 gauge, 3.55c; black sheets, 28 gauge, 4.35c; galvanized sheets, 28 gauge, 5.70c; box, Pittsburgh, plus rail freight to destination. These prices, of course, are for domestic trade, overseas export trade being governed by export conditions. In many instances, Canada is considered a part of the domestic market. As usual, business is taken for the half-year in the case of manufacturing consumers and for the quarter in the case of jobbers, the quarter in this instance being the third. In general, however, the Steel Corporation subsidiaries do not do great deal of business with jobbers. The corporation has some important jobbing warehouses of its own.

It is assumed that the entire tonnage of sheets and tin plates the American Sheet & Tin Plate Company will be in a position to furnish will be taken up quickly by regular customers, and as was the case when books were opened November 15 for the present half-year the business will be done largely by way of making allotments to customers, rated according to amounts the respective customers have received in the past. Present contracts in tin plate will be worked out by some time in July, but the sheet business will not be completed before the early part of August. The delay is due to the restriction in operation early in the year caused by shortage of coal and steel, and by the present shortage of steel. While the company has lately been operating approximately 95 per cent. of its sheet mills, only about 75 per cent. of this is against regular sheet sales, that being the extent of the sheet bar supply, the balance of the operation being by conversion contracts, taken simply to avoid idleness of the mills. The sheet consumers bought the sheet bars and are simply having the company roll the bars into sheets, at set prices for the conversion.

A feature of the market and general industrial situation is that wide variety of views now entertained by various observers. Never, perhaps, was there such diversity of opinion. Some men. particularly bankers, are predicting a "panic" next August or September, though what variety of panic they do not state, since it is practically the universal opinion that through the Federal Reserve banking system put in operation late in 1914 a money panic is practically impossible. Hitherto panics in the United States have been primarily money panics, though the phenomenon may be ascribed to money being the most vulnerable thing, whereby if money panics had not occurred there would have been panics of other descriptions instead.

Then there are other observers who predict that there will be a general readjustment, or "shake-out," not necessarily of particularly panicky character, some time next year, perhaps about a year hence. In both cases the fundamental idea is that there is great inflation and that business cannot be conducted for an indefinite time on the inflated basis.

There are, however, still other observers who insist that no man is wise enough to know that the country cannot continue on the present basis, or even get along with still higher wages and commodity prices. They do not assert positively that it can, but assert that no one can be sure that it cannot.

As to the steel market in particular, there are likewise widely divergent opinions. The monthly ingot report of the American Iron and Steel Institute, just issued, indicates that production of steel ingots in March was at the rate of about 45,200,000 gross tons a year, previous rates having been 44,200,000 tons in February and 40,650,000 tons in January. The March output was much larger than had been expected, for there were various operating difficulties, particularly car shortage. Incidentally, the showing suggests that the real capacity of the country is nearer 55,000,000 tons of steel ingots a year than the 49,000,000 or 50,000,000 tons estimated until quite recently.

From this large output in March opposite conclusions are drawn. One conclusion is that when output was so large, with shipments slightly exceeding output as a little of the steel accumulated at mills in January and February was moved, and with some shipments long on the road reaching consumers, the rate of consumption is seen to be extremely large, and much greater than was assumed, on the basis that all this steel was absorbed without steel becoming plentiful, for the appearances are that steel is still scarce. The argument continues that if the present lines of consumption can absorb so much steel, there will be a scarcity when the railroads come to taking large quantities and when something like normal quantities are absorbed in large construction projects generally. Accordingly steel prices will not decline but will rather advance.

The opposite argument is that whether or not one can observe a diminution in the scarcity of steel the heavy shipments must be making steel more plentiful, since there is much more steel being produced than buyers expected when they pushed up the market by bidding against each other. Accordingly, steel prices will soften, and in the not distant future, even though later on heavier buying might come. The softening would be by way of independent prices dropping to the Steel Corporation level, not of the Industrial Board price schedule itself yielding.

Thus there are opposite conclusions from the same general premises. Meanwhile the market is very quiet as to transactions outside the Steel Corporation sales.

PIG IRON TRADE

The pig iron market continues generally dull but with prices still keeping firm. In some districts a little more action has taken place. The demand for deliveries on contracts keeps insistent and would tend to show that foundries are keeping up production. In the Pittsburgh and Youngstown district the output of pig iron for March showed a large increase over February, and April is expected to show an increase over March. Basic iron in this district is at an average price of $41.50 and Bessemer at $42, valley furnace; No. 2 foundry grade is at a minimum of $43, valley furnace. In the Chicago district the market is dull and prices in some instances have softened a little. There have been no large orders during the week, the biggest thing noted being an order of 1,500 tons malleable for Wisconsin delivery. In the Buffalo centre there has been more activity shown during the past week than for some time, the sales amounting to 10,000 tons. The market is firm, No. 2 plain being on a basis of $45, with $46.25 and $48 for the next two grades. The car situation is better than it has been, and furnaces are increasing their production. The reports from Cleveland show a quiet market, with prices remaining firm, $43 being the base price. Sales have been in the neighborhood of 5,000 tons, the Westinghouse Co. taking the larger part of this amount. Some iron for prompt shipment has been sold by outside interests for $44. Some consumers are asking for deliveries to be hurried up, their request being that last half iron be delivered to them in the third quarter. New York, Philadelphia and St. Louis report a quiet market, though in the St. Louis district there has been a considerable amount of buying for prompt shipment.

U.S. SCRAP METAL

The scrap market all over the United States seems to be suffering from a period of inactivity. This is accompanied in many cases by a softening in prices. In others, the transactions have been so small as to make it impossible to establish prices. Pittsburgh is a case in point. The only transactions have been small lots bought from other dealers, and it is probable that consumers could secure material at less than the quoted prices. Heavy melting steel is quoted at $27 and cast iron wheels from $41 to $42. The Chicago district reports a very soft market, with a decline in prices in most grades. At the same time the railroads are offering a large amount of material, amounting to about 10,000 tons. There has been some selling of heavy melting steel in the Buffalo district, one interest buying about 2,000 tons at a price said to be $25 per ton. Other grades are not showing much activity. In New England, according to reports from Boston, there has been some heavy buying of No. 1 cast scrap, which was on a $45 to $46 delivered basis, besides which a fair amount of No. 2 cast changed hands. Stove plate has been also somewhat livelier, one interest having bought over 1,000 tons of this grade at a price of $33 to $34. No. 1 heavy melting is on a basis of $20 to $21 in this district. St. Louis, New York, and Cincinnati, all report dull markets without any feature of interest.

DUTCH EAST INDIES IRON INDUSTRY

The Mining Department of the Government of Netherlands India has recently issued a comprehensive report on the possibilities of the development of iron mining and iron and steel manufacture in the island of Celebes, Netherlands India. Government engineers have made extensive preliminary studies and surveys of the entire situation, and it appears that either the Government or private enterprise will undertake the development of the field in the near future, although the part the Government may take in the actual control of the industry has not as yet been fully determined.

Iron Ore Deposits and Available Water Power

The largest ore field to which recent investigations have been directed are those of central Celebes in the Larona district, lying near Towoeti Lake. The survey of this field showed 160,000,000 tons of ore, containing an estimated iron content of 5,000,000 tons; and there is believed to be 5,700,000 tons of iron in an additional 210,000,000 tons of ore that have not as yet been completely surveyed and tested. This field holds the best promise for early and profitable development, since it lies within 25 miles of a deep-water bay on the coast and may be very largely worked by electric power, which can be generated from several waterfalls along the Larona River. This river flows from Towoeti Lake to the sea, descending about 300 meters in a distance of 20 miles; about 200 meters of this fall occurs within a length of about 8 miles. In this distance it will be possible to utilize four falls of approximately 45, 25, 30, and 80 meters, respectively, the last-mentioned fall of 80 meters to be attained by the construction of a dam 45 meters high in addition to the natural fall of 35 meters. There is also a possibility of utilizing other falls of about 25 meters above those mentioned, as well as falls below of an additional 50 to 60 meters.

Computing the natural overflow from the Towoeti, Mahalona, and Matano Lakes, together with the average rainfall draining into the river, it is estimated that 2,610,000,000 cubic meters of water are carried annually by the Larona River, or an average volume of 83 cubic meters per second. Having the lakes as natural reservoirs for retaining the heavy rainfall of the rainy season through the dry season, the rate of at least 80 cubic meters per second should be maintained throughout the year.

BOOK REVIEW

"The Relation Between the Elastic Strengths of Steel in Tension, Compression, and Shear," by F. B. Seely, associate Professor of Theoretical and Applied Mechanics, and W. J. Putnam, Associate of Theoretical and Applied Mechanics, has been issued as Bulletin No. 115 of the Engineering Experiment Station of the University of Illinois.

The severe uses to which carbon and alloy steels are put in some phases of engineering, as for example, in automobile and in aeroplane construction have developed a need for more detailed knowledge of the action of steel, under various types of stress, as well as of the factors which affect the physical properties of the material.

Our knowledge of the breakdown of elastic action of ductile materials, particularly in the case of combined loading, is far from complete. The various theories of combined stress lead to results which differ rather widely when applied to various machine parts or to structural elements, such as trick cylinders, flat plates, crank shafts, webs of girders, etc. The maximum shear theory of combined stress for ductile materials as expressed by Guest's law, which has gained rather wire acceptance in recent years, assumes that the elastic shearing strength is one-half of the elastic tensile strength. Available experimental results, have, in general, failed to justify this assumption. The importance of the limitation imposed by the shearing stress upon the elastic strength of ductile material is, of course, generally recognized. It is of special importance to know the relation between the shearing and the tensile (and compressive) elastic strengths for various grades of ductile and semi-ductile steels. The main object of the investigation herein recorded was to determine carefully the elastic shearing strength of ductile and semi-ductile steel and to find the ratio of the elastic shearing strength to the elastic tensile strength with the hope that definite information would thereby be obtained on the breakdown of the elastic action of various grades of steel and on the limits of the theories of combined stress.

Apart from the problem of combined stress there has been also a lack of knowledge of the correct elastic shearing strength of various grades of steel and of the general nature of elastic shearing failure as well as of methods of determining the correct shearing strength from tests.

This bulletin presents the results of experiments with six grades of steel, three carbon steels and three alloy steels, namely, soft, mild, and medium carbon steel, and vanadium, nickel, and chrome-nickel alloy steel. The elastic strength in tension in compression, and in shear is given for each of the six grades of steel.

Copies of Bulletin No. 115 may be obtained without charge by addressing C. R. Richards, director, Engineering Experiment Station, University of Illinois, Urbana.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$42 40
Lake Superior, charcoal, Chicago	57 00
Standard low phos., Philadelphia	50 00
Bessemer, Pittsburgh	43 00
Basic, Valley furnace	42 90
Toronto price:—	
Silicon, 2.25% to 2.75%	52 00
No. 2 Foundry, 1.75 to 2.25%	50 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 50
Steel bars, base, Toronto	5 50
Iron bars, base, Montreal	5 50
Steel bars, base, Montreal	5 50
Reinforcing bars, base	5 00
Steel hoops	7 00
Norway iron	11 00
Tire steel	5 75
Spring steel	10 00
Band steel, No. 10 gauge and 3-16 in. base	6 00
Chequered floor plate, 3-16 in.	9 40
Chequered floor plate, ¼ in.	9 00
Staybolt iron	9 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	4 00
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 90
Small shapes under 3"	3 62

FREIGHT RATES

	Per 100 Pounds. C.L.	L.C.L.
Pittsburgh to Following Points		
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

	Gross. Montreal	Toronto
Lake copper	$25 00	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	77 00	75 00
Spelter	12 50	12 25
Lead	12 00	12 00
Antimony	14 50	14 00
Aluminum	34 00	35 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 7 25	$ 7 25
Plates, ¼ up	6 50	6 50

Price List No. 38

WROUGHT PIPES

Standard Buttweld

Per 100 feet

	Steel Blk.	Steel Gal.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Gal.
⅛	$ 6 00	$ 8 00	$.....	$.....
¼	4 83	6 96	5 31	7 44
⅜	4 83	6 96	5 31	7 44
½	6 42	7 99	7 10	8 67
¾	8 11	10 24	9 03	11 16
1	11 99	15 13	13 35	16 49
1¼	16 22	20 47	18 06	22 31
1½	19 39	24 48	21 59	26 68
2	26 09	32 93	29 05	35 89
2½	41 24	52 07	.....	.....
3	53 93	68 09	.....	.....
3½	68 54	85 56	.....	.....
4	81 21	101 37	.....	.....

Standard Lapweld

Per 100 feet

	Steel Blk.	Steel Gal.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Gal.
2	$29 79	$36 63	$33 49	$39 96
2½	43 58	54 41	49 43	60 26
3	56 99	71 15	64 64	78 80
3½	70 38	87 40	79 58	96 60
4	83 39	103 55	94 29	114 45
4½	95	1 19	1 20	1 45
5	1 10	1 39	1 40	1 69
6	1 43	1 80	1 81	2 19
7	1 87	2 36	2 34	2 83
8L	1 96	2 48	2 46	2 98
8	2 26	2 85	2 84	3 43
9	2 71	3 42	3 40	4 11
10L	2 51	3 17	3 15	3 81
10	3 23	4 08	4 06	4 90

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	Per 100 Pounds. Montreal	Toronto
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Copper, crucible	18 00	18 00
Copper, heavy	18 00	18 00
Copper wire	18 00	18 00
No. 1 machine composition	16 00	17 00
New brass cuttings	11 00	11 75
Red brass cuttings	14 00	15 75
Yellow brass turnings	8 50	9 50
Light brass	6 50	7 00
Medium brass	8 00	7 75
Scrap zinc	6 50	6 00
Heavy lead	7 00	7 75
Tea lead	4 50	5 00
Aluminum	19 00	20 00
	Per Ton	Gross
Heavy melting steel	18 00	18 00
Boiler plate	15 50	15 00
Axles (wrought iron)	22 00	20 00
Rails (scrap)	18 00	18 00
Malleable scrap	25 00	25 00
No. 1 machine cast iron	32 00	33 00
Pipe, wrought	12 00	12 00
Car wheels	22 00	26 00
Steel axles	22 00	20 00
Mach. shop turnings	11 00	11 00
Stove plate	25 00	25 00
Cast boring	12 00	12 00

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Carriage bolts, 7-16 and up	Net
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Wrought washers	45
Elevator bolts	Net
Machine bolts, 7/16 and over	Net
Machine bolts, ⅜-in. and less	15
Blank bolts	Net
Bolt ends	Net
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square, blank	add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 50
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

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Fin. and Semi-fin. nuts, over 1 in., up to 1½-in.	10
Fin. and Semi-fin. nuts over 1½ in., up to 2-in.	Net
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws .... list plus 20,	30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

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	Per gross ton
Bessemer billets	$60 00
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Spikes, ¼ and 5-16 in.	8 00

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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Vol. XIII, No. 17. April 22, 1920

Troubles Caused by Moisture in Compressed Air

It is a Well-Known Fact That Moisture in Compressed Air is Something to be Avoided—The Discussion Explains How This Trouble May be Overcome

By F. A. McLean

MOISTURE in compressed air should always be avoided as much as possible, especially where it is to be used to operate reciprocating or rotating mechanisms on which it has a pernicious effect when carried into the working parts, tending to wash away the lubricant, thereby increasing the wear and shortening the life of the moving parts through leaving highly finished and closely fitted surfaces bare, and in sliding or rolling contact with each other. While this is true of practically all air-operated machines, it is particularly so in the case of those operating at high speeds, such as hammer drills, pneumatic tools, motor-driven air-hoists, sand rammers and the like, in which the surfaces exposed to wear are of necessity limited in size, and since air underpressure is hard to hold, the parts are machined to very close limits, and wear is particularly objectionable on the ground of lowered economy through increased air consumption and loss of power.

While moisture in wet air is bad enough in interior piping, its effects are likely to be far worse out of doors in open cut mining, quarrying, contracting, shipbuilding, switch and signal work, etc., where it is likely to collect at low points in the system, causing water hammer with consequent racking effect on the joints and loss of power through reduction of the air passages, as well as increasing the danger of freezing and bursting of the pipes during cold weather. The low temperatures caused by the rapid expansion of the air from the exhaust of rock drills, pneumatic hammers and other air-operated devices will often freeze the moisture, clogging the exhaust openings and preventing their efficient operation.

On railroad switch and signal work, freezing is a very serious matter, as, should these devices fail to funcation at the proper time through the freezing of the working parts, it is likely to cause considerable loss of life and property.

Time is generally an important factor in contracting and mining operations and losses in this respect are usually of more importance than in other directions. It is, therefore, essential that the proper precautions be taken to ensure freedom from interruptions which are too often caused by freezing of the pipe lines, drills or tools. In a case of this kind which came to the writer's attention late last fall, operations at a large Eastern mine were held up and the miners forced to sit around and "swap" stories for two hours while waiting for the pipes to be thawed out. This did not happen on a cold day, but on one that was damp and muggy.

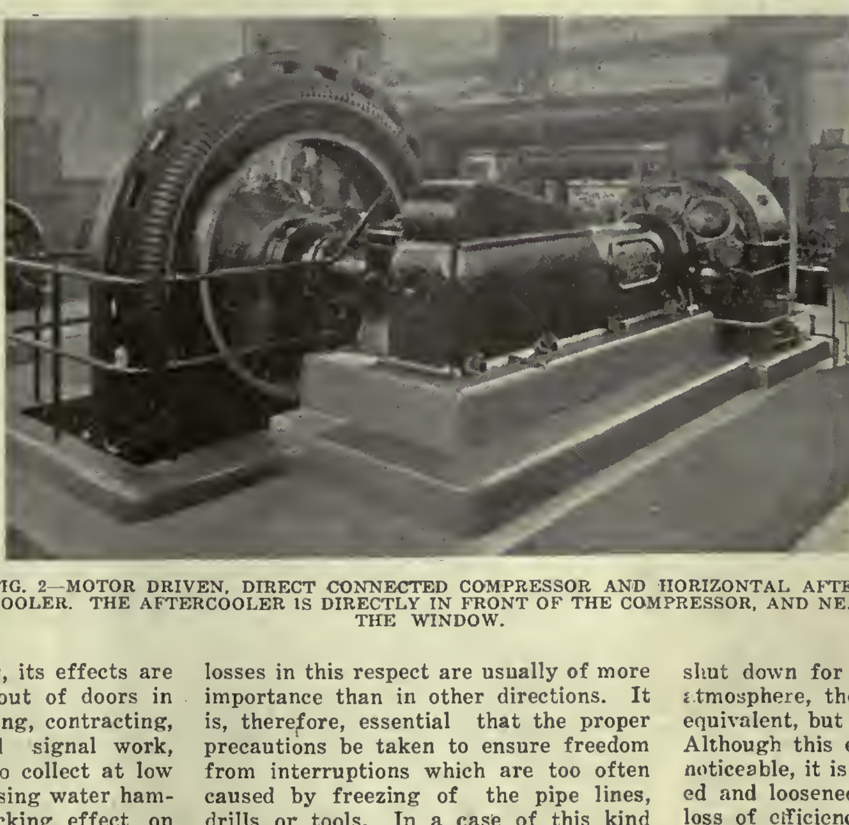

FIG. 2—MOTOR DRIVEN, DIRECT CONNECTED COMPRESSOR AND HORIZONTAL AFTERCOOLER. THE AFTERCOOLER IS DIRECTLY IN FRONT OF THE COMPRESSOR, AND NEAR THE WINDOW.

While it is possible to compress air, it is practically impossible to compress water and sometimes breakage of the working parts of a tool is caused by too much water in the air lines. Pneumatic tools and other air-operated equipment are designed to operate on air and are not adapted for "hydraulic drive."

Where tools or drills are operated on air which contains an excessive amount of water and are then allowed to remain idle for a while without proper attention they soon get rusty and it is usually not long before losses from air leakage and maintenance costs grow larger.

The Importance of Cool Compressed Air

Air discharged from the cylinder of a compressor is hot in comparison with the atmosphere, and on entering the supply pipe lines heats them to some extent. this heating effect travelling further along the pipe lines with the continued operation of the compressor causes them to expand gradually, with the result that when the compressor is shut down for the night, in the cooler atmosphere, they are subjected to an equivalent, but more violent contraction. Although this effect may not be readily noticeable, it is likely to result in strained and loosened joints, with consequent loss of efficiency through leakage.

Aftercoolers—The Remedy

It is a well-known fact that atmospheric or free air always carries moisture (the amount varying with meteorological conditions in different localities),

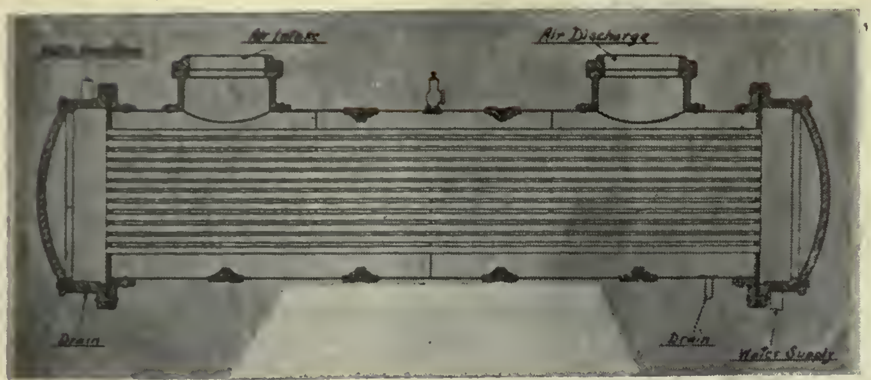

FIG. 1—DIAGRAMMATIC VIEW OF A HORIZONTAL AFTERCOOLER.

and that it also has the capacity to absorb more up to the time that its saturation point is reached.

The moisture carrying capacity of air increases rapidly with rises in its temperature and decreases, but not quite so rapidly with increases in pressure. As the pressure will always be at the highest point just as the air is leaving the compressor, if we can reduce its temperature to the lowest point, the air will be in a position to give up so much of its moisture that there will be little or none left to cause trouble when lower pressures and mayhap higher temperatures are reached further along the line. It is thus evident that the remedy for these conditions lies in reducing the temperature of the air after it leaves the compressor and before it enters the pipes, to as low a point as possible, which will not only prevent all of these troubles, but will ensure better all around distribution efficiency as a whole. Some cooling takes place in the intercooler of a compound or state compressor, and with the larger and better designed intercoolers used on modern compressors, more of the moisture is removed by this means than was possible with the older types. The air receiver also cools the air to some extent and serves as a receptacle for the collection of moisture from the air which passes through it, and for this reason is fitted with cocks by which the moisture can be drawn off at intervals.

In the simplest form of compressed air power plant, the receiver is the only means of removing moisture from the air that is employed. Too much reliance should not be placed on the receiver for this purpose, however, as when located close to the compressor as it should be and the consumption of air is heavy, the temperature of the receiver shell will usually be such that little or no condensation can occur. In some cases, the temperature of the receiver becomes so high that oil carried from the compressor cylinder becomes ignited, causing serious fires or explosions. It is, therefore, better to depend on some means of cooling and drying the air after it has left the compressor and before it enters the receiver and supply lines, and this is where the aftercooler "fits in."

What the Aftercooler Will Do

Aftercoolers cool and dry the air more thoroughly than is possible with the best type of receiver, and so reduce to a minimum the troubles which follow the use of wet air, and in addition remove some of the oil which might be carried into the receiver and perhaps to the pipe lines, to the detriment of the air supply hose. While of considerable importance in mining, quarrying and contracting, especially in tunnels and shafts where oil in the exhaust of rock drills or coal cutters tends to vitiate the air, clean air is even more of a necessity in the case of foundries or in wood-working and textile plants where the air is used for cleaning machinery, or spraying paints, varnishes and other finishes, and the aftercooler is of great value under such conditions.

One of the principal functions of an air receiver is to compensate for the pulsating effect of each stroke of the compressor piston and prevent rapid fluctuations in the air pressure. For this reason the receiver should have sufficient capacity to prevent any material rise in the receiver pressure by the volume of air forced into it at each stroke of the compressor piston. If the air is allowed to pass directly into the supply pipes, there will not be sufficient space for its immediate accommodation and the pressure will momentarily run up far in excess of the average pressure in use, accompanied by a periodic acceleration of flow. This results in an increase in the frictional resistance of the pipes and at the end of each stroke the compressor piston is required to force the air out of the cylinder against a pressure temporarily greatly in excess of normal, increasing the power consumption and putting an unnecessary strain on the compressor. In a single cylinder compressor the discharge pulsations are more violent than in stage compressors, as the total discharge must take place from a cylinder of larger diameter in a smaller portion of the stroke than is the case with the high pressure cylinder of a multistage compressor where the discharge valves open earlier in the stroke and the diameter of the air pipe is about one-half that of the cylinder. In this respect the installation of an aftercooler, since it increases the available receiver capacity, will be of considerable benefit, especially in intermittent work, such as running rock drills, pneumatic tools, hoists, etc., and will assist the governor

AIR AFTERCOOLERS

80 TO 100 POUNDS AIR PRESSURE

Number	Size of Aftercooler		Actual Square Feet of Cooling Surface	Pipe Connections			Maximum Capacity of Aftercoolers in Cu. Ft. of Free Air per Minute with Cooling Water at								Shipping Weight lbs.	
				Air			60° F.		70° F.		80° F.		90° F.			
	Diameter Shell Inches	Height or Length Feet and Inches		Inlet, Inches	Outlet, Inches	Water Inlet and Outlet	Single Stage Compression	Two Stage Compression	Single Stage Compression	Two Stage Compression	Single Stage Compression	Two Stage Compression	Single Stage Compression	Two Stage Compression	Domestic	Export
1	14	10'-0"	55	5	4	1	253	360	230	330	207	297	186	268	1800	2160
3	20¾	10'-6"	152	8	6	1½	705	1170	640	1051	575	957	518	860	3000	3600
5	22½	14'-6"	305	10	8	2½	1410	2360	1280	2135	1150	1920	1035	1725	4200	5000
7	30	17'-8"	757	14	10	3	3500	5840	3180	5299	2880	4750	2590	4270	8500	10200
9	39	19'-0"	1497	18	11	5	6900	11500	6280	10479	5650	9400	5100	8450	16100	19300
10	45¼	19'-0"	2012	18	14	6	9300	15500	8450	14084	7600	12650	6850	11350	19700	23700

FIG. 3—TABLE SHOWING CAPACITIES OF INGERSOLL-RAND HORIZONTAL AFTERCOOLER.

or regulator of the compressor in maintaining a steadier pressure.

Aftercoolers usually consist of a cylindrical steel or cast iron shell with cast heads supported on cast iron foot pieces surrounding a nest of iron or brass tubes, the ends of which are either expanded or fitted with copper ferrules and caulked into steel tube plates at each end of the casing, provision being made for expansion and contraction. Water enters the lower set of tubes, traverses each row and leaves at the top of the shell, while the air enters and leaves at the top, surrounding the tubes in transit and travelling in a direction opposite to the water. Baffle plates are arranged so as to cause the air to cross and recross the tubes several times. An open funnel is generally placed in the water discharge to show the amount of water flowing and facilitate its adjustment. The moisture collected from the air is prevented from escaping with the latter by a plate in front of the air discharge opening.

There is some difference of opinion as to the respective merits of iron and brass tubes for this class of service. Brass is a better conductor of heat than iron, but on the other hand, galvanized iron tubes are usually rougher and present more surface to the air, so that there is probably little or no difference between them in cooling effect. Vertical aftercoolers are sometimes preferred on account of the smaller floor space which they occupy, but aside from this, there is no reason for using one style in preference to the other. While aftercoolers of different makes vary in minor details, the essential principles of all are the same and their construction will be more readily understood by referring to Fig. 1.

Aftercoolers are usually equipped with pressure gauge, safety valve, flanged pipe connections, water fittings and drain cocks. When properly designed and supplied with the requisite amount of water they will readily reduce the temperature of the air passing through them to within 15 or 20 degrees of the entering cooling water. The temperature and quantity of the latter required depends on the cooling effect desired. The following figures which are based on good cooling results with air at 80 to 100 pounds gauge pressure when compressed by a two-stage machine, will be found accurate for use with aftercoolers of the type described:

Temperature of Cooling Water	Gallons per hour per 100 cu. ft. of actual free air per min.
50 Degrees Fahr.	120
60 Degrees Fahr.	150
70 Degrees Fahr.	180
80 Degrees Fahr.	210
90 Degrees Fahr.	240

Aftercoolers are made in a number of different sizes, the capacity of which varies with the temperature of the cooling water, and whether the air to be cooled is obtained by single or multi-stage compression. This point will be seen more clearly by examining the table in Figure 3, giving the sizes and capacities of Ingersoll-Rand aftercoolers.

An aftercooler may be suspended from the ceiling or mounted on or under the floor, as may be most convenient from the standpoint of economy of floor space or ease in making the necessary connections. It should be placed between the receiver and the compressor and as close to the latter as possible. Pipe of amply large size should be used in making the necessary connections and care should be taken to provide piping by which the moisture may be drained off at intervals. It is good practice to make connections from the compressor to the aftercooler and from the aftercooler to the receiver, one or two sizes larger than that leaving the receiver, using reducers to make the actual connections if necessary. Elbows should be avoided, any bends that are necessary being made by giving the pipes a wide sweep.

In some localities water is scarce, and where this condition exists it is often possible to use the cooling water from the aftercooler for hot boiler feeding, increasing the efficiency of the plant and adding to its economical operation to some extent through the recovery of waste heat.

While an aftercooler will not eliminate all of the moisture from compressed air, the best results in this respect, especially in the case of large installations, being obtained by the use of an aftercooler in conjunction with a number of small secondary receivers or moisture traps (of which there are a number now on the market, one of the best known as the Stratton) placed at intervals along the supply lines, it will be found that in the majority of cases the aftercooler alone will dry the air to such an extent that the troubles due to wet air and the consequent inconvenience and low efficiency which follows, are entirely done away with.

In addition to this, the installation of an aftercooler often results in increased economy in power consumption with no outlay other than the cost of the aftercooler, the necessary connections and a moderate supply of cool running water. It is thus evident that the inclusion of an aftercooler when securing estimates on new compressed air plant, or the addition of one to a plant already in existence, is a subject well worth the attention of anyone desirous of obtaining the highest efficiency from their compressed air equipment.

NEW MACHINE TOOLS FOR CANADIAN MARKET

It will be interesting to the Canadian machine tool trade in general to know that the Albert Herbert, Ltd., of Coventry, England, have opened up a Toronto office. Their present headquarters are at 31 Yonge Street, but this is by no means their permanent abode. They have merely opened up this office until they complete arrangements regarding proper warehouse premises.

It is their intention to carry in stock a representative line of machines made by the Albert Herbert, Ltd., also other various companies that they represent. They already have a number of machines en route for Canada, and it is their intention to have their stock assume considerable proportions in the near future.

One big point in their favor is the fact that the staff will consist of both practical and technical men who are thoroughly versed in modern machine tool practice, and intimately acquainted with the machines they will handle.

This allows them to be in a position to furnish the trade with all necessary technical information, and give full service in as far as service and the obtaining of maximum production is concerned. In addition to their own lines, they will handle other tools which are new to the Canadian market, a list of which follows:

The Webster & Bennet, Coventry, line of boring mills and automobile profilers.

The G. Stirk & Sons, Halifax, line of planers and boring mills.

The H. W. Kearns Co., Manchester, Horx boring, milling and facing machines.

The Lumsden Machine Co., Ltd., Gateshead-on-Tyne, line of grinding machines.

Power and hand presses made by J. Rhodes & Sons, Wakefield.

The L. Gardner & Son, Pancroft, Manchester, line of crankpin turning machines.

The Tangyes Limited, Birmingham, line of heavy machine tools.

The Britania Foundry Co., Coventry, line of foundry appliances.

The Manlove Alliot & Co., Ltd., Nottingham, line of oil separators.

The W. D. McKendrick & Co., Motherwell, line of girder radial drilling machines.

The B. Smith & Sons, Todmorden, line of chain mortising machines.

The Moses Eadon & Son, Ltd., Sheffield, line of high speed and carbon steels, saws, machine knives.

The Scriven & Company, Leeds, line of shipyard and rolling mill equipment.

The Vulcan Foundry Co., Ltd., Newton-le-Willows, line of Vulcan pneumatic riveter for locomotive work.

The George Taylor & Sons, Coventry, line of small vertical milling machines.

The H. Wallwork & Co., Ltd., Manchester, line of gear generating and hobbing machines.

The E. C. Wrigley & Co., Ltd., Birmingham, line of twist drills, reamers, milling cutters.

The E. G. Herbert & Co., Manchester, line of hack sawing machines and small tools.

The H. Atkins, Ltd., Peterboro, line of light machine tools.

The Herbert Eng. Company, Reading, line of floating tool holders.

J. Buckton & Co., Ltd., Leeds, line of heavy machine tools.

This varied line illustrates on what a scale the Herbert Co., Ltd., have entered the machine tool market. Many of these lines have special points of interest which will be presented to readers in the near future. Anyone interested can be assured of courteous treatment and careful attention at the hands of Mr. Blair, who is the representative of this company.

The Magnetic Chuck, Its Design, and Various Uses

A Continuation of Last Week's Article on the Principles of Design, Together With Various Uses of This Style of Chuck in the Modern Manufacturing Plant

By J. H. Moore

In Fig. 5 we show the work, B, bridging one of the gaps, but not the second gap. In this case the leakage induced by the intermediate piece is very much increased and therefore the pull correspondingly decreased. Theoretically this chuck is made up of independent poles. However, since all these poles are joined at the lower end magnetically and this end is carried up in the form of an enclosing wall which forms the body of the chuck, we really have a series of north and south poles along both sides of the chuck. This is most plainly demonstrated in the cross-section, AA, Fig. 3. In Fig. 6 this type of chuck is shown in use on a milling machine and from the diagram it is evident that a shunt magnetic circuit passes uninterrupted from the bottom of the chuck through the machine, returning by way of the milling cutter and therefore under these circumstances not only the machine, but the cutting tools themselves, will become magnetized. With the multiple-pole chuck, the magnetism that is shunted through the machine is produced by the magnetic force of one pole and alternates in polarity as the tool passes along the work. Magnetized tools accumulate and hold a certain amount of chips and steel dust which rapidly dull the cutting edges. The magnetized machine attracts iron dust and therefore invites wear to an undesirable degree.

In Fig. 7 we show a single-pole form of chuck which consists of a single-pole piece that fits on top of the main pole of the magnet.

In this type of chuck the body forms one pole and the serrated pole face forms the other. The two parts are held rigidly in proper relation by filling the space with a non-magnetic metal. This chuck has one advantage over the chuck shown in Fig. 3 in that there are no neutral spaces between adjacent poles in the pole face. The disadvantage of this type of construction lies in the use of a single-pole in connection with a serrated pole face, because a pole face of this kind provides an air gap of short length and very large area, which means a large amount of flux can leak through the circuit of the section, AA, is exactly the same in Fig. 3 as it is in Fig. 7. However, on account of the fact that the body of the multiple-pole chuck is utilized as a part of the magnetic circuit only to a slight degree and depending upon the work mounted on it, the magnetizing effect of the single-pole chuck is very much greater under the same circumstances because the total magnetism is polarized in one direction.

Fig. 11.—Simmons Unit-Pole Magnetic Chuck suitable for toolmakers.

In Fig. 8 we show the effect of placing the work on the single-pole chuck in such a way that the area over one pole is very much less than that over a second pole. From this diagram it is evident that small pieces of work unless properly placed will have a very much reduced magnetic pull exerted upon them because the small area on one side, in this instance, north, is quickly saturated with magnetism which forces the rest of the

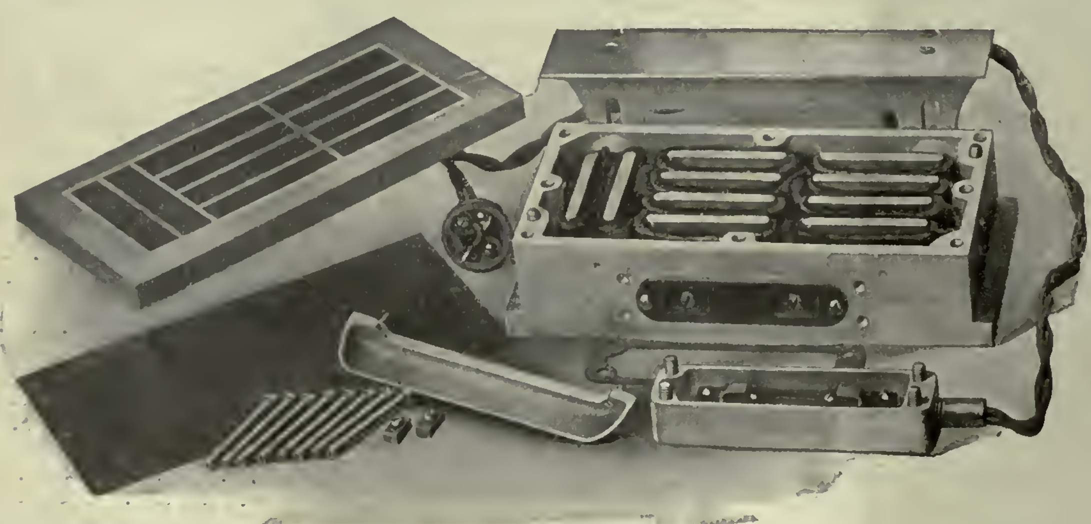

Fig. 12.—The same Chuck as used by toolmakers, disassembled.

circuit formed in the body of the chuck. The face-plate is made up of a grid, the bars of which are cast integral with the body and the spaces between the bars are filled with projections from a pole

cuit unless the work that is on the chuck covers a considerable area.

Referring to Fig. 6 where we show the multiple-pole chuck mounted on a milling machine we see that the magnetic

Fig. 13.—Complete disassembled view of Simmons Unit-Pole Magnetic Rotary Chuck.

rounding them, the combination being included in a frame, which is attached to, and forms part of, the body of the chuck.

By mounting magnetic circuit, E, inside the body, F, and separating the two by non-magnetic material at all points of contact there are never any circumstances under which the magnetism will travel through the body of the chuck, therefore there can be no leakage from the chuck into the machine or the tools. In fact, the body of the chuck with this type of construction, when of iron, forms an effective barrier, or screen, for magnetism, so that magnetism from inside the chuck cannot get out, nor magnetism from the outside get in.

On account of the unit construction the magnetism produced in each pole passes into the adjacent pole piece, and nowhere else, which means a short path of maximum area and results in maximum magnetism and pull in a given space.

By interlocking the poles a condition such as shown in Fig. 8 is practically impossible. Furthermore, the interlocking produces a pull that offers con-

magnetism to leak out into the air. Then, too, it should always be borne in mind that when the permeance of the magnetic circuit is decreased by introducing air gaps or placing the work so that it saturates more in one place than another the total amount of magnetism produced by the exciting coils is less than when the work is so mounted on the face-plate that equal areas are in contact with opposite poles.

In Fig. 9 we show the construction of a unit-pole magnetic chuck. In this chuck the magnetic circuit is a complete unit entirely separate and distinct from the body of the chuck. The magnetic circuit is of the multiple-pole type and the face-plate is made up of a series of interlocking pole pieces mounted in position with non-magnetic metal between their adjacent sides and completely sur-

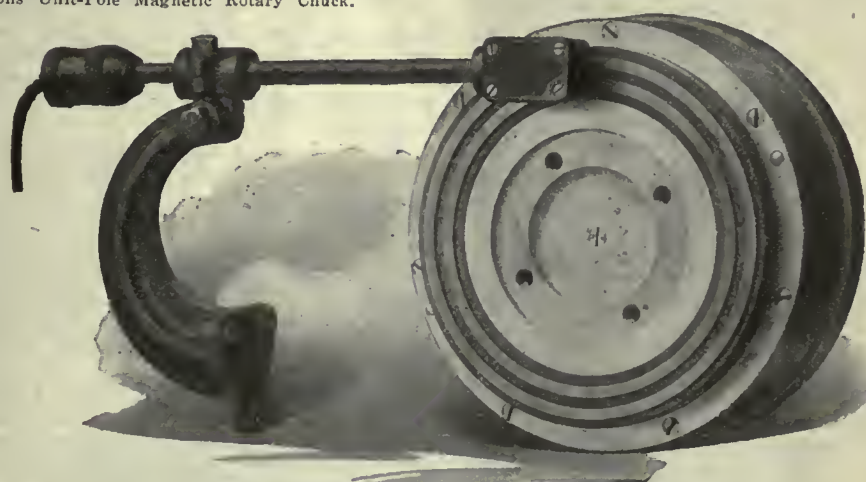

Fig. 14.—Rear view of the same chuck showing current transmitting mechanism.

Fig. 15.—Magnetic Chucks find many applications for which they were not originally intended. Scraping gibs is an example here illustrated.

Fig. 16.—Application of ten-inch aluminum body Magnetic Chuck to second operation work on a Lodge & Shipley lathe.

siderable resistance to forces acting across the chuck. With straight parallel pole pieces a piece of work can be moved in such a way as to not change the number of lines of flux passing into the work and therefore there will be little resistance offered to motion in this direction.

In the Simmons unit-pole chuck the work, no matter how small it is (down to one inch square), cannot be moved in any direction without changing the number of lines of flux that pass over the work, and therefore it will oppose forces in all directions.

Although a large number of different types of these chucks are made, the basic principles of construction are practically the same. We have for illustrative purposes chosen an 8 x 10 in. chuck, which is shown disassembled at Fig. 10. This type is what is known as a rectangular T-slot chuck.

In this photograph the magnetic circuit with coils in position is shown in the body of the chuck. The face-plate and terminal blocks have been removed. The switch for magnetizing or demagnetizing the chuck can be installed at any convenient point on or near the machine. Leads run from one side of the switch to the supply line, and from the other side to the chuck. Of course this type of chuck is equipped with rubber hose covering for all lead wires, so that the chuck can be used for wet grinding as well as dry grinding. The back rest and back-plate as shown can be completely removed from the face-plate, as can also the end stop if desired. The end stop and back rest are also adjustable as far as height is concerned. On this style chuck two gaskets are used, one between the face-plate and body of chuck, the other between the terminal box and the chuck body. The object is obvious, namely, to make the chuck absolutely watertight.

Of course all the coils in the chuck are wound for the same resistance, a definite number of which are connected in series for 110 volts, half as many in series for 55 volts, and twice as many in series for 220 volts. The one shown, however, is too small to contain enough coils for such a voltage as 220, so that when it is to be used on the 220 circuit a special resistance unit has to be connected in series with the chuck.

Fig. 17.—Simmons T-Slot Magnetic Chuck used for holding cast iron pieces in a vertical milling machine. Note carefully that chips are piled just as they naturally fall, and are not governed by magnetism. It should also be noted that the tool is perfectly free from any clinging pieces of iron.

On the other hand chucks that are large enough to contain a sufficient number of coils for 220 volt operation can be changed over to 110 volts by connecting in parallel a number of 110 volt groups. Special terminal blocks are used on 220 volt chucks which permit this change to be made without trouble. The use of the back rest is so self-apparent that comment is hardly necessary.

At Figs. 11 and 12 we illustrate a 4½ x 9½ unit-pole chuck, which is made with an aluminum body. It is also equipped with a special arrangement of pole pieces to facilitate the application of auxiliary devices on the face-plate. Such a chuck as shown is specially applicable to tool-room work, both for its general utility and lightness, as the complete chuck weighs only 15 pounds.

At Fig. 12 we show it disassembled, and its construction is exactly the same as previously described, with the exception that the body and frame of face-plate, also the back rest, is made of aluminum. The coils are arranged somewhat differently but are the standard type, and in the same relative proportions.

The Rotary Chuck

We next show a disassembled view of a 10-in. rotary unit-pole magnetic chuck at Fig. 13. The body in this case is also made of aluminum. The face-plate when assembled is located by dowels, and a gasket placed between the plate and the body once more guaranteeing the chuck to be watertight.

In this style chuck an auxiliary face-plate is often used for extremely small work. Briefly the auxiliary plate is mounted on top of the standard plate in such a way as to carry the poles toward the centre. A bronze ring one-half the thickness of the face-plate holds the poles in position.

A rear view of this chuck, showing the method of connecting the current-transmitting mechanism, is shown at Fig. 14. The bracket as illustrated is mounted on the machine wherever desired, and as noticed, this bracket is so arranged as to be adjustable.

Fig. 18.—31 x 10¼ Magnetic Chuck mounted on Brown & Sharpe milling machine. The work is a piece of cold rolled steel 31 inches long, 4 inches wide, and ¾ inches deep. The cut is 4 inches wide by 7-16 inches deep. The feed is 1 5-16 inches per minute. The cutter 2¾ inches in diameter and is running at 69 r.p.m.

Various Applications

The possible uses for magnetic chucks are almost infinite in variety. This is especially true when the application of auxiliary pole pieces is considered. The subject is largely one of education and experience, and as the engineer and mechanic become educated in the application of magnetic principles the use of magnetic chucks is sure to extend to fields even greater than at present contemplated.

To commence with, let us look at Fig.

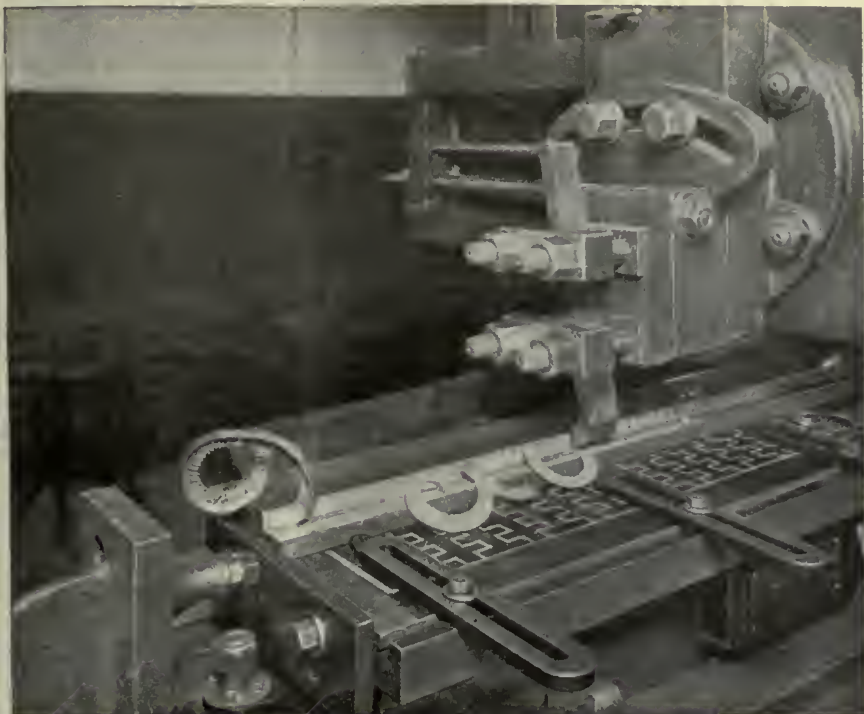

Fig. 19.—The holding power of the Magnetic Chuck is well exemplified in the illustration The chuck is 31 inches long by 10¼ inches wide. The work is a piece of cold rolled steel 31 inches long, 4 inches wide and ¾ inches deep. The chip is ⅝ inches deep and 3-16 inches thick, the table feed being 40 feet per minute. It stalled the machine at the point where the cut stopped.

15. Here we see a very good application of the use of a magnetic chuck, and one for which perhaps it was not originally intended. The workman is shown scraping gibs. He can concentrate on his task in hand, feeling sure the work will not move. Another advantage of using a chuck for this style of work is that it will hold the work firmly, which would perhaps become deformed through gripping in a vise. By this method strains are eliminated and no deformity can occur.

At Fig. 16 is illustrated an application of a 10-inch aluminum body rotary chuck on a Lodge and Shipley lathe. This chuck is used on second operation work as shown. The bracket carrying the brush rigging is plainly seen at the right. It is hardly necessary to comment on the efficiency of a magnetic chuck for work of this character, for its time-saving qualities are self-apparent. A chuck of this nature has also the advantage of giving a uniform support to the work without the application of any undue force at one point which would tend to cause distortion.

The use of a T slot chuck on a vertical miller is shown at Fig. 17. It is used in this case for holding cast iron pieces in position while being milled. An interesting feature in connection with this photograph is the fact that it furnishes evidence that there is perfect insulation in the magnetic circuit, for otherwise the chips could not be in the natural position as shown. The tool itself is also free from any clinging pieces of iron, again proving this point.

Another milling operation is shown at Fig. 18. This illustrates a 31 x 10¼ in. chuck mounted on a Brown and Sharpe miller. The work being performed is that of a piece of cold-rolled steel 31 inches long, 4 inches wide, and ¾ inch deep. The cut being taken is 4 inches wide by 7-16 inch deep. The feed is 1 5-16 inches per minute. The cutter is 2¾ inches diameter, and is running at 69 revs. per minute. From these figures one cannot help but admit that a magnetic chuck has more holding power than often accredited it.

The next photograph, Fig. 19, exemplifies once more the holding power of a magnetic chuck, together with its variance of uses. The chuck illustrated is 31 inches long, 10¼ inches wide, and is installed on a 30-inch planer. The work being held is a piece of cold-rolled steel 31 inches long, 4 inches wide, and ¾ inch deep. The chip being taken is ⅝ inch wide and 3-16 inch thick, and the table speed is 40 feet per minute. So great was the speed of the table feed that it stalled the machine at the point where cut is shown to end. Of course, as can be noted, the back and end stops, together with side stress clamps, are employed, but one can readily realize the necessity of these in work of such a heavy character. It speaks well of the chuck's holding power to think that even though the planer stalled the work stayed in position.

Some Grinding Installations

It is in the field of grinding that the magnetic chuck is perhaps best known. At Fig. 20 we show an application where V-blocks are employed in the grinding of brass washers. The V-blocks are made from steel and the sides of the V-block are undercut to a knife edge, and of such thickness that the knife edge grips the edge of the washer with sufficient power to hold it.

Another case where special designed chucks can be used to good advantage for special purposes is shown at Fig. 21. In this case the chuck contains four longitudinal poles. The two adjacent poles in the middle are carried as shown and machined to receive the small wedges, three of which may be seen on the front of the chuck. These wedges are only ⅜ inch long, 3-16 inch wide, and

Fig. 20.—Showing the application of V-blocks in the grinding of brass washers. The V-blocks are made of steel and the sides of the V are under-cut to a knife edge and of such thickness that the knife edge grips the edge of the washer with sufficient power to hold it.

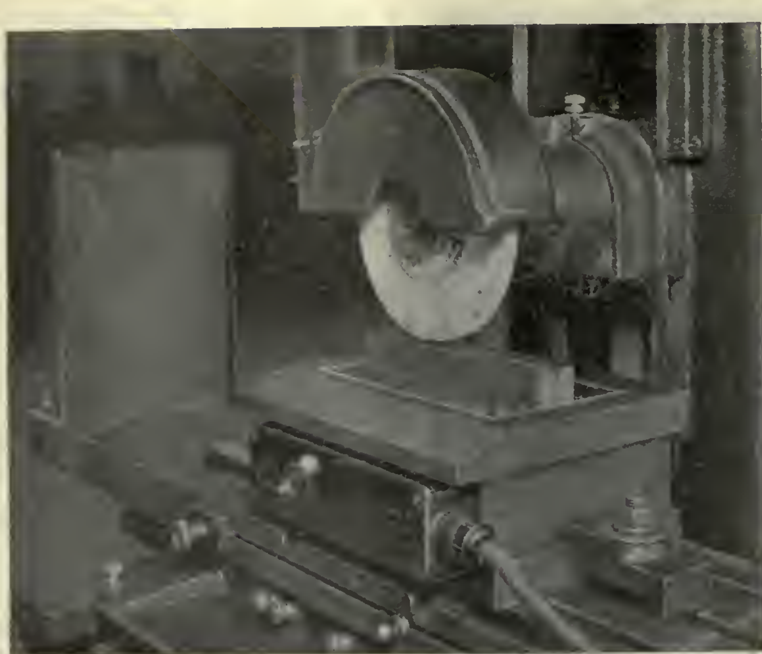

Fig. 21.—Magnetic Chucks are often made up in special designs for special purposes. In this instance, the chuck contains four longitudinal poles. The two adjacent poles in the middle are carried as shown and machined to receive the small wedges, three of which may be seen on the front of the chuck. These wedges are ground to an extremely accurate angle. The face of the chuck is accurately ground to determine this angle and the pull exerted upon them is 210 pounds per square inch, which assures very perfect seating on the holding surface.

are ground at a bevel of 14 degrees, 2 minutes, and 6 seconds. The face of the chuck is accurately ground to determine this angle, and a pull of 210 pounds per square inch is exerted, which assumes a perfect seating on the holding surface. It is in such cases as this that the advantage of magnetic chucking is apparent.

At Fig. 22 we illustrate a special auxiliary pole piece for use with the regular chuck when grinding a definite bevel. The pull of all the poles is transmitted to the two auxiliary poles as illustrated. It will be noticed that these poles are made up of two pieces separated from each other by a strip of brass with feet staggered in such a way as to rest on alternate poles of the chuck.

There should be no hesitation in accepting the magnetic chuck as a valuable asset in the manufacturing plant and machine shop of to-day. As stated at the beginning of one article, it is lack of education in their uses that precents their being as well known as they should be, and it is a safe prediction to say that magnetic chucks are bound to become more and more popular as their uses and merits are realized.

STEEL TREATERS ORGANIZE

The 14th of April will always remain an important date in the minds of those interested in heat treatment. The need of some channel through which experiences in the heat-treating field may be exchanged has been felt in Canada for some time, but it remained for the American Steel Treaters' Society to offer the solution.

It is unnecessary to comment on the good work accomplished by this organization. Enough to say that, realizing the need of such a society in Canada they instructed their national secretary, Mr. W. H. Eisenman, to visit Toronto and acquaint Canadians of their opportunity of joining the American society.

A meeting was held in the King Edward Hotel, at which Mr. Eisenman presided. He briefly but very forcefully explained the aims and purposes of the American Steel Treaters' Society.

"The purpose of the society is not to make money for itself," said Mr. Eisenman, "but to promote the arts and sciences connected with the heat treatment of steel; to hold meetings (by the establishment of local chapters) for the reading and discussion of papers bearing upon processes, instruments, equipments, apparatus, etc., employed in practical and research work connected with the art; to collect, publish and disseminate technical and practical knowledge for the improvement of conditions in connection with the heat treatment of steel, and to closely unite those engaged in the practical and technical branches of the same."

The recognition and reception our society has received since its establishment is a marked indication of the worth of its aims and objects—and the confidence of the craft at large in the spirit, judgment, sincerity and vision of the founders.

Local chapters of our society have been established in Chicago, Cleveland, Pittsburgh, Milwaukee, Philadelphia, Cincinnati, Buffalo, Rochester, New York City, Minneapolis-St. Paul, Tri-Cities (Davenport) and St. Louis. Other chapters are in process of formation, and the membership of hundreds is further distributed throughout the United States, Canada, Italy, France, Japan, England and Australia.

All the papers and discussion before the various local chapters are collected, published and sent to you through the pages of the society's monthly publication, "The Journal," and thus you will be able to keep in touch with the best and latest progress and development in all industrial centres.

No one person knows or can conceive of anyone knowing all about heat treatment. No one makes such a claim, yet there are many with excellent worth-

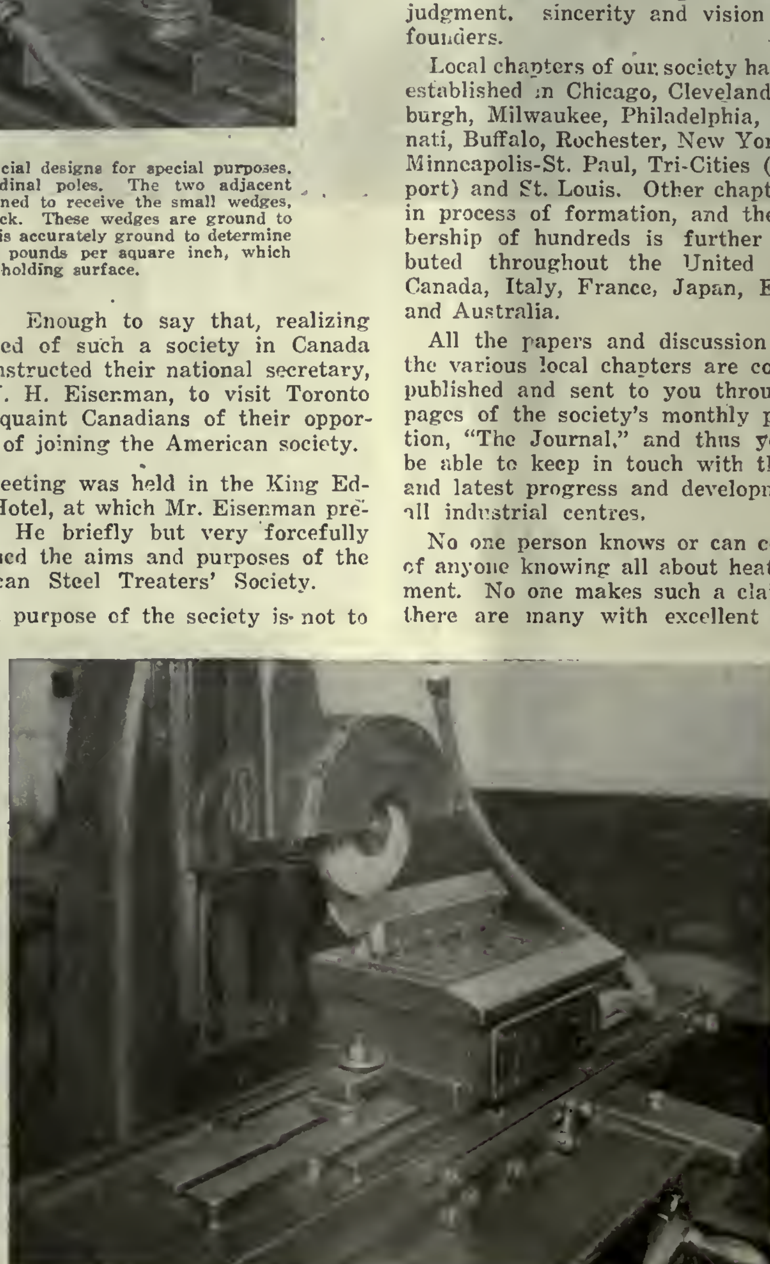

Fig. 22.—Special auxiliary pole piece for use with Simmons Unit-Pole Magnetic Chuck when grinding a definite bevel. The pull of all the poles is transmitted to the two auxiliary poles as plainly shown on the above illustration. It will be seen that the auxiliary poles are made up of two pieces separated from each other by a strip of brass with feet staggered in such a way as to rest on alternate poles of the chuck.

while ideas and improved methods, who are more than willing to effect an even exchange.

Advantages of Membership

The advantages of membership in the society are many; you will receive "The Journal"; be entitled to the free use of the Employment Service Bureau; receive valuable data sheets, and have the privilege of attending meetings of any chapter of the society.

The journal of the society is the best publication in the heat-treating field. Its main articles in every issue are written by experts in their line and they are both practical and theoretical. All the papers presented at the annual convention of the society in September are being published from month to month in the journal. A series of special articles on "Practical Talks on Case Hardening" appear every month. Special arrangements have been made so that new members may secure back numbers of the journal at small cost. In addition to the main articles there are also important departments such as the editorial, book reviews, correspondence, employment service, commercial items, and abstracts of recent patents of interest to heat treaters. The Board of Associate Editors is composed of some of the leading research men of the country who have contributed papers to the Journal and are continuing to do so.

The need of a Toronto chapter is self-evident and, my appeal to you to start such a local chapter will, I feel sure, receive a hearty response, because then you will have the privilege of attending regular monthly meetings in your own locality, at which papers and discussions of interest to the workers in steel will be read and discussed by men who know the practical side of the game as well as the theoretical. At these meetings friendships and associates will be formed that will be of inestimable value to you. You will become acquainted with the men in your own line of work. There you can talk over your troubles and experiences with others, and compare notes. The day when a man believed that he had secrets in his heat treating department he could not divulge is passing rapidly, and the open door policy of the exchange of ideas is gaining rapid headway.

You might ask whether you ought to join such a society, to this I would say: "If you are in any way interested in the manufacture of steel, the manufacture of tools, machine parts, the heat treatment of same, or the use of the finished product, you will find the American Steel Treaters' Society to be a real and practical benefit. No matter in what line of activity you may be engaged if the products you use are heat treated you should be interested in membership and would receive practical benefit and help from the society."

Every firm should be represented, because you need not receive but one small idea a year in order to feel more than repaid for the dues.

Membership in the society now includes: Leading manufacturers, general managers, superintendents, work managers, metallurgists, chemists, supervisors of heat-treating rooms, furnace men, sales representatives,. designers, purchasing agents and inspectors.

This educational movement, founded for the increased efficiency of all those interested in heat treating, deserves your strongest support. It is educational in its purposes, co-operative in its management. All money received from all sources is all devoted to making the society of greater value to the members.

It is only by having all people who are interested become members that we shall be able to secure the greatest and best results.

After Mr. Eisenman had concluded his address he asked for the opinions of those present. Each speaker was very enthusiastic in his ideas regarding the possibilities of such a society in Canada, and after various views had been heard on the subject it was unanimously decided to start a local chapter.

Officers were elected, and the first meeting of the new chapter was fixed for Tuesday. April 20.

Invitations were forwarded to those interested, and while every effort was made to reach all parties concerned it was felt that many had probably been omitted from the list, it being impossible in such a short time to cover the field completely.

CANADIAN MACHINERY takes this means of still further inviting anyone interested to attend. It is not necessary to be actually engaged in the heat treating business. Anyone is welcome, no matter what their position. The main thing is this:

Are you interested in heat treatment? If so, your place is at these meetings. They will be held once a month and we shall acquaint readers through our columns with the activities of the organization.

We cannot too strongly endorse the necessity of such a society. In these days of strenuous competition the old haphazard methods of guessing the temperature, etc., are past. We must know what we are doing to the steel, why we are doing it, and what the results will be. These facts will be discussed and spoken of by the very best authorities on the subject, as the society will bring in from time to time various speakers to talk on heat treatment in its many phases.

We strongly advise anyone interested to enquire for further information of Mr. A. Lowry, secretary-treasurer and chemist of the Massey-Harris Co.

Following were the officers elected: J. H. Moore, associated editor, CANADIAN MACHINERY, chairman; H. A. Phillips, mechanical engineer, Canadian Cycle and Motor Co., vice chairman; A. Lowry, chemist, Massey-Harris Co., secretary-treasurer; executive committee: Charles N. Dawson, metallurgist, Machine & Stamping Co.; Chester Hamilton, president, Hamilton Gear & Machine Co.; Charles Hack, chief inspector, Canadian Allis-Chalmers Co.; W. O. Oliver, superintendent, Steel Company of Canada.

Those present at the initial meeting: W. F. Sutherland, editor "Power House"; Capt. Grant, chief inspector, and A. G. Marr, superintendent of heat-treating department Willys Overland Co., Ltd.; Mr. Lay, sales manager, and W. W. Doran, salesman of the Keystone Products Co.; A. P. Inglis, manager, and P. G. Christie, salesman, of the Crucible Steel Co. of America; W. Oliver, superintendent, T. Holmes, superintendent of heat treating and G. Wyse, master mechanic of The Steel Co. of Canada; James Lewis, superintendent of the John Inglis Co.; J. W. Brown, superintendent of the Capewell Horse Nail Co.; Gordon Lee, mechanical superintendent, Machine & Stamping Co.; J. H. Martin, president of the Precision Tool Co.; W. J. Trybell, Canada Metals Co.; Chas. Bailey, manager. Jessop Steel Co.; J. W. Bartlett, works manager, Chase Tractor Co.; George Wilkins, superintendent of tools, Bawden Machine Tool Co.; T. J. Segwick, machinery superintendent, C. Hack, chief inspector, and G. Farrar, mechanical superintendent of the Canadian Allis-Chalmers Co., and N. B Ferguson, manager, Edgar Allen Co., Ltd.

An array of names such as these cannot fail to impress readers with the fact that the need of proper heat treatment is recognized by the big men. Show you are interested by writing for all details; in other words, get behind them and help place Canada on the map in so far as studying and discussing heat-treating methods and practices are concerned.

A new French tool steel, known as Etiquette Rouge is according to L'Importateur Francais, a cast steel containing tungsten and suitable for the manufacture of screw taps and dies. It can easily be tempered and resists corrosion, it is claimed, to a remarkable degree. After being carefully and completely heated to a bright red at a temperature of from 760 deg. to 780 deg. C, it is dipped in water at about 15 deg. C. Small sections can be dipped at a lower temperature. A second grade of tool steel, K9, used in making precision tools, is also described. This steel, it is said, is practically free from expansion and contraction during tempering. Its treatment requires gentle and complete heating at from 780 deg. to 880 deg. C., and the use of an oil bath. The two steels are delivered annealed and ready to be worked.

A substitute for cork can be made, according to the "Berlingske Tidende" by the action of acetylene on the oxides of copper and nickel.

The city of Calgary, Alta., is asking for tenders for the supply of three 200 k.v.a. 12,000 volts to 2,300 volts transformers. Specifications can be had from the city engineer. Tenders to be addressed to the city clerk, Mr. J. M. Miller.

WELDING AND CUTTING

Lessons on the A.B.C. of Good Welding

These Articles Will Give Valuable Hints on the Art of Good Welding—The Second Lesson Will Appear in an Early Issue

By W. B. Perdue*

ONE of the first things that must be taught a student of any mechanical trade is to handle his tools in a professional and effective manner.

One point that often escapes attention and is vitally important to the proper manipulation of the welding torch, is elimination of wrist motion. The torch must be kept on the job. If permitted to bob up and down, or to swing in any otherwise irregular movement, the action of the oxygen in the air on the melting metal in the weld will greatly reduce its strength and efficiency.

The torch must be swung across and the flame played upon both sides of the metal to be welded by a free arm motion in which the elbow and shoulder form the only axial points.

A long oscillatory movement in which the torch swings in the direction AB (Fig. 1) will be found the easiest to acquire and in practice the most rapid and economical. The turns at each end of the stroke should be made in a right-hand direction, like the hands of a watch, when using the torch in the right hand. This overcomes the tendency to assume a "Spencerian slant" as in penmanship, and has certain other advantages.

Music in Business

This movement must be regular and rhythmic. When the Government demanded an intensified training course for welders I originated the phrase, "Whistle a waltz while you are working and get the music into your weld." The tests of time have proved the value of this important, but often neglected, part of the welder's training.

To acquire proficiency in this motion requires considerable patience and practice. It is, however, the foundation of all good welding, and can be mastered by anyone who will devote sufficient time

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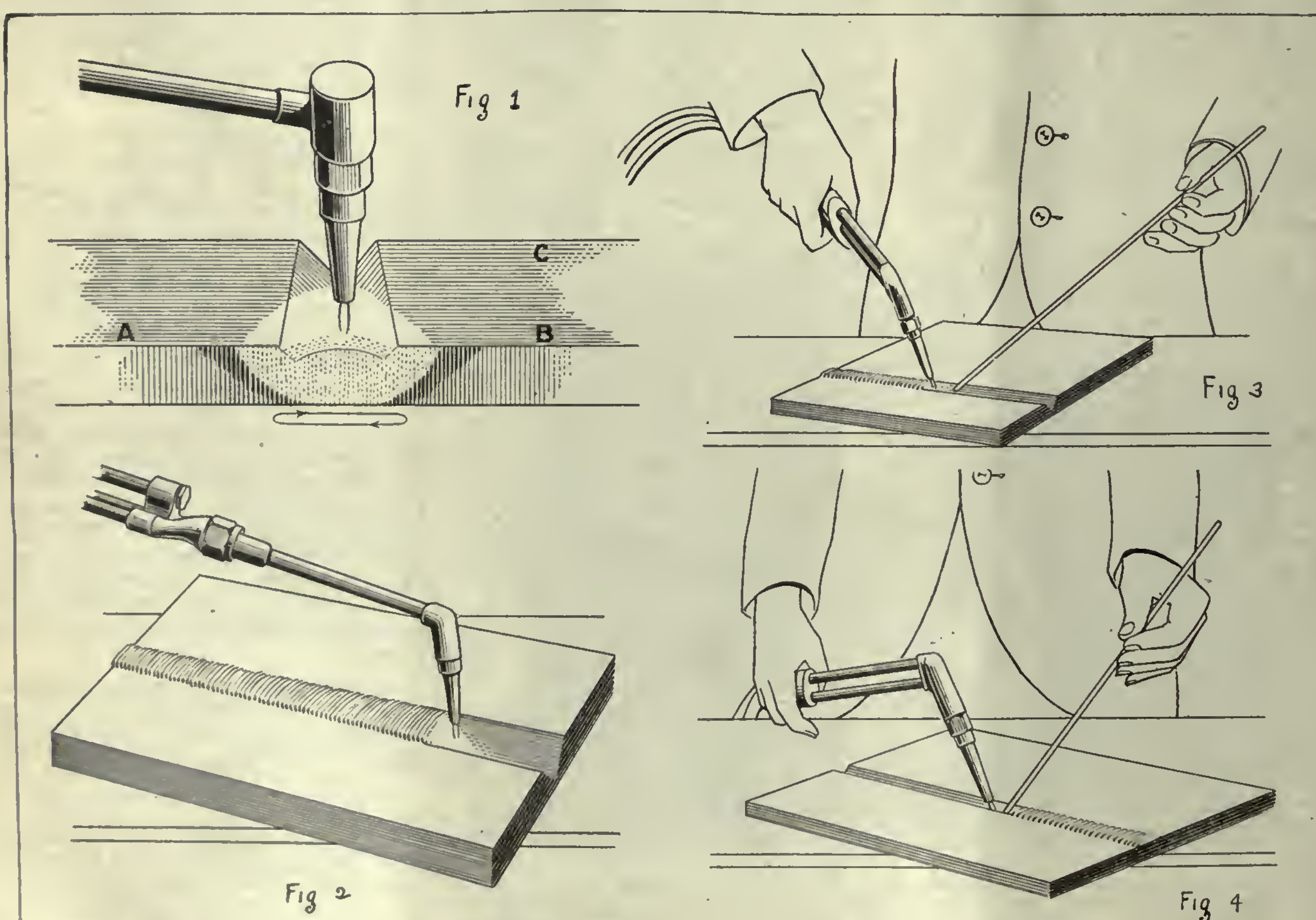


FIGS 1 TO 4—ILLUSTRATING VARIOUS WAYS OF HOLDING THE TORCH.

and effort thereto. To a very great extent the progress of a welder and the quality of his work can be determined by the skill with which he manipulates his torch and rod. In all cases it is certain that metal that is "plastered on" hit and miss cannot produce a sound weld.

New Method Used

In Fig. 2 is shown a method that was formerly more commonly used than at present. Here both the torch and the flame are directed in the line of welding, with the work progressing away from the operator. It is still in use by many operators on light sheet steel and barrel work. Others modify the method slightly by drawing the handle of the torch toward them enough to keep the hand and the hose from being directly over the heated section just welded. In some cases the filler rod is worked into the weld behind the flame and beneath the torch.

This method of handling the filler rod is not especially recommended. It is believed that greater proficiency is possible by handling the rod in such manner that the same relative position can be assumed for both rod and torch in surface, side, vertical and overhead welding, and to some degree in handling any and all metals. This method and the modification next illustrated utilizes the heat of the outer envelope of the flame to preheat the section to be welded. This preheating not only increases the speed of the work and decreases the cost but also tends to produce a better weld.

Position Used in Welding

Fig. 3 illustrates the proper position for holding both rod and torch. Here the line of welding is also away from the operator but not directly so. The heel of the torch is held sufficiently high to permit the tip to point in the same direction as the line of welding. The tip may be permitted to incline very slightly toward the operator. Under no circumstances must the torch hand be allowed to sag and direct the flame against the side of the weld opposite the operator in the slovenly manner illustrated in Fig. 4. It is of the utmost importance that both edges of the weld shall be in perfect fusion. To direct the flame against the opposite side would cause it to melt first and to be washed by the right hand motion against the side next the welder and merely stick without welding and without strength. Inclining the flame slightly toward the side of the weld next the operator insures fusion of that side that is less distinctly visible, while the right hand motion of the torch supports the metal and prevents it from flowing down until the opposite side is in proper fusion. The same applies to the left hand motion of the welder who holds his torch in his left hand; the metal on the side toward him is similarly supported.

Method of Securing Position

To secure the proper position it is necessary to grasp the torch in the hand firmly in such manner that the thumb and the tip point in parallel directions. Depress the head of the torch until the hose lines are felt to touch the wrist or forearm. Bending the wrist in this manner may at first be tiresome, but it is necessary to prevent wrist motion. By devoting considerable attention to the proper holding of the torch and the development of the welding motion previously described, a graceful free-arm motion will be acquired which swings the torch across the weld and maintains the uniform height of the tip from the melted metal.

The tip should not be held too near the vertical, since in this case the pre-heating effect of the envelope or secondary flame is not properly applied. Holding the tip too near the vertical also tends to prevent proper combustion of the remaining elements of the acetylene that should be consumed in the secondary flame, with the result that they may be deposited as impurities within the weld. This position also tends to overheat the tip and head of the torch, with the result that the acetylene may be broken down into other gases, which may cause the weld to be seriously defective. Some prominent authorities contend that a torch should flash under such misuse and thus warn the operator of his error.

Oxygen Used

When the tip is inclined at an angle of about 60 degrees to the plane of the weld sufficient oxygen will be drawn in from the air to completely consume the combustible gases in the outer envelope. For each cubic foot of acetylene drawn from the generator or cylinder, about ten cubic feet of the surrounding air is robbed of 75 per cent. of its oxygen content. This, with proper manipulation of the torch, creates a zone which protects the weld. Oxygen should be drawn from the air and not from the oxygen cylinder. Its ability to deoxidize the surrounding air accounts for the superiority of the oxy-acetylene over all other welding processes.

Fig. 4 is an illustration of how not to hold the welding torch in this position or in any other lax position which permits wrist motion to be imparted to the torch, is an indication of slovenliness which should at all times be avoided.

Some instructors permit students to weld backward as shown in Fig. 4, their contention being that beginners who attempt to weld forward, as shown in Fig. 3, may flow the melted metal from the rod ahead and over the unmelted edges to be welded. In welding cast iron, brass, copper, and aluminum, it is essential that the welder be able to work forward; in welding steel it is very desirable to be able to work either way.

The only solution, therefore, is for the beginner to practise on scrap steel until he is able to secure proper penetration while working forward and to avoid driving the melted metal along the weld in front of the torch. He should thoroughly master the principles of the art and practise until thoroughly competent to execute a good weld. There is no surer way to injure your own good reputation and that of oxy-acetylene welding than to fall down on a job for a customer.

The student who thoroughly masters the art of welding forward will find no difficulty in welding backward whenever the occasion demands. Therefore, let us learn how to weld forward, first, as any division of effort which causes us to divert time or attention from these essentials will but delay progress and invite failure.

Beginners may hasten their progress by practising several hours per day with a sharpened stick or rod—anything that will cast a pointed shadow—the point of which should be held about ¼ inch above the diagram below Fig. 1. The shadow cast by this stick should be made to follow the diagram, using only elbow and shoulder motion, keeping the wrist bent at all times so that the upper end of the stick is in contact with the forearm.

The output of lead and silver by the Bawdin Mine, in Burma, for the year 1918 was valued at over £1,000,000, although it was only worked on a comparatively small scale. It is now extending its work so as to increase its output from 20,000 tons of refined lead per annum to 7,000,000 oz. per annum. With plant which will shortly come into operation it will be able to produce, in addition, 40,000 tons of zinc product, and 25,000 tons of copper per annum.

The Electric Furnace Construction Co. of Philadelphia have recently installed and successfully started up electric furnaces of the "Greaves Etchell" type in the following plants:—Dodge Steel Casting Co., Philadelphia; American Radiator Co., Buffalo, N.Y.; and the Hammond Steel Co., Syracuse, N.Y.

A new process of electroplating, described in a paper read by Mr. O. P. Watts before the American Electro-Chemical Society, comprises the immersion of iron for a few moments in an acidified solution of arsenious oxide. By these means an adherent copper-plate may be deposited from an acid electrolyte, but no adequate explanation has been offered for this unique effect of arsenic. Certain solutions of lead and antimony may be substituted for the arsenic dip, previous to the direct-current plating of copper on iron from copper sulphate. It appears to be impossible to obtain a perfect plate on iron from solutions of bismuth chloride by the usual methods of electro-plating; but use of the arsenic or antimony dip is attended with the same success as in copper plating. The successful substitution of solutions of antimony and lead for arsenic, and the application of these dips to plating on iron with bismuth, show that the beneficial effect of the arsenic alone, but is the result of coating the iron with a metal whose potential in acid solutions is so near to that of copper that it is possible to deposit a good copper plate upon it, yet whose potential is not so far below iron that it will deposit on iron in a powdery, non-adherent form.

DEVELOPMENTS IN SHOP EQUIPMENT

MILLER ATTACHMENTS

The Ryerson-Conradson Co. have, in conjunction with their helical drive miller, placed on the market a dividing head and vertical milling attachment.

The vertical attachment is shown at Fig. 1, and as can be noted, this attachment is of the semi-universal type.

The fixture fits both their plain and universal machines, and is made in light, medium, and heavy patterns.

The base is clamped to the column dovetail, no dependence being placed on the overarm. The heavy pattern type has the same diameter spindle and the same size bronze bearings as the main spindle. The taper hole face plate and driving keys also are the same, permitting as heavy a cut to be taken as on the horizontal spindle.

The drive is effected by a large aluminum bronze gear bolted to the face plate of the main spindle and driven by the cross key. In return, it engages a steel gear on a horizontal shaft, driving the vertical spindle through a set of bevel gears. This allows the spindle to be set at any angle parallel to the face of column. A draw-in bolt is furnished.

The dividing head as shown has been designed to meet the exacting requirements of modern shop practice. It is especially rigid and provided with an extra large worm wheel, meshing with a worm journaled in large bearings. The worm and worm shaft are of one piece, made of high-grade steel, heat treated and then ground to secure extreme accuracy. Means are provided for quickly disengaging the worm from spindle and to take up all backlash that may arise in the course of time. The spindle and face plate are forged in one piece from high carbon steel. This design provides an exceptionally rigid arrangement for mounting chucks and fixtures on the face plate. The hole through the spindle is very large, 3 1-16 in. in diameter, and a No. 14 B. & S. taper is used. The face plate is 8 in. in diameter, has 24

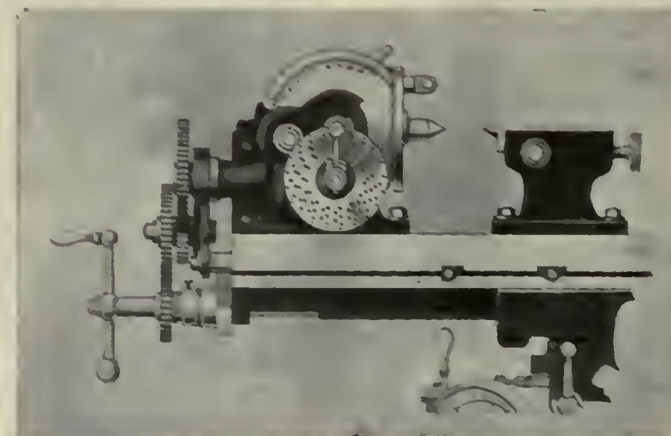


FIG. 2—GENERAL APPEARANCE OF UNIVERSAL DIVIDING HEAD.

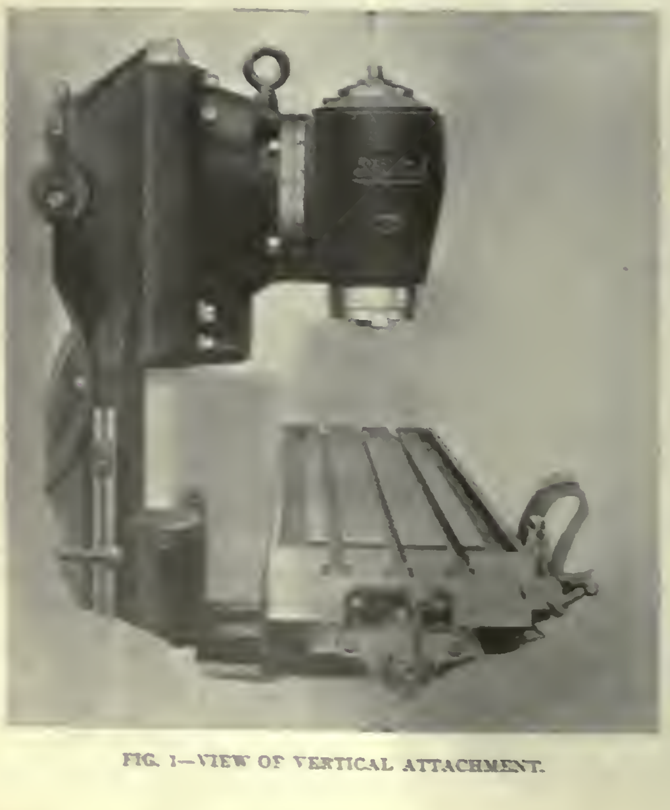
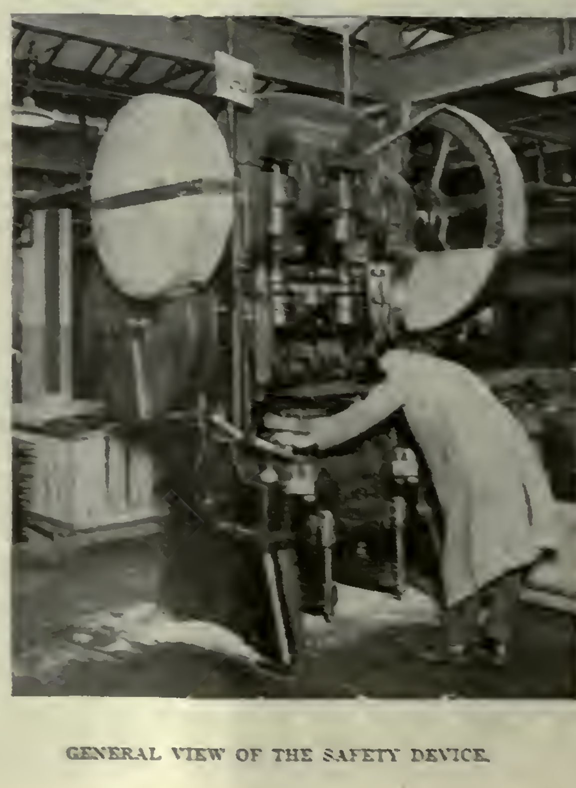


FIG. 1—VIEW OF VERTICAL ATTACHMENT.



GENERAL VIEW OF THE SAFETY DEVICE.

holes for direct indexing and a ⅝ in. x 7-32 in. slot for holding the driving dog. The centres will swing 14¼ in. in diameter. The head is graduated and can be securely clamped in any position from 10 degrees below horizontal to 10 degrees beyond the perpendicular. The entire dividing head shows careful designing, especially in the absence of delicate details.

The regular equipment consists of three index plates that divide all numbers to 50 and many beyond; wrenches, bolts, driving dog and index table giving all divisions up to 360.

LEVER SAFETY ATTACHMENT FOR SIDE PRESSES

The accompanying photograph illustrates a motor-operated side press in use in the machine shop of the Square D Co., Detroit, which is provided with an effective safety device for protecting the hands of the operator. The press is actuated by a tread or lever, which throws the clutch. Without the safety device the operator, while operating the press with his right hand may unconsciously fail to remove his left hand from the metal he has placed on the die and thus lose his fingers or perhaps his entire hand when the press closes. To prevent this inadvertency a lever is provided also for the left hand. This is connected in the rear of the press to the right-hand lever by means of a rod. Both levers, right and left handed, must be held down at once to throw the clutch. To press but one only raises the opposite lever and allows the clutch to slip. The operator is compelled to keep both hands out of danger in order to operate the press.

This side press, as shown, stamps, presses, perforates and fashions sheet-steel into boxes which are used to enclose the live parts of electric switches—a protective device for household and industrial users of electric current.

NEW THINGS IN MACHINE TOOLS

The Superior Collet Chuck Company of Grand Rapids, Mich., are now making a new type of collet chuck for drilling machines.

The Victor Tool Company, of Waynesboro, Pa., has recently placed on the market a new collapsible taper-cutting pipe tap. Some interesting details are incorporated in the design of these tools. Sizes range from 2 to 12 inches.

The Bicknell-Thomas Company, of Greenfield, Mass., has added to its line a vertical tapping machine for bench use, with a capacity from 0 to 3-16 in. taps. A special work fixture may be used in place of the ordinary table. The machine stands 15 inches high and weighs about 48 pounds complete.

The Atlas Press Company of Kalamazoo, Mich., are placing two new arbor presses on the market, one of 6 ton and the other of 15 ton capacity. They are adapted for a variety of work, such as forcing arbors in and out of work to be turned, for straightening and broaching operations, in assembling parts where force fits are required, and for other similar purposes.

A special line of air-operated chucks for service on Jones and Lamson double-spindle turret lathes has been developed by the Frank G. Payson Co., of Chicago, Ill. The body of the chuck is made in one piece and requires no adapter for its attachment to the spindle. The air chuck is located at the rear of the spindle and is connected to the chuck by a rod running through the hollow spindle.

A special tool for use in drilling machines, for the counterboring of holes, facing, forming and similar operations, has been placed on the market by the Genesee Manufacturing Company of Rochester, N.Y. These tools are made in two styles, with two and three cutters, and each style is made in four sizes, ranging from 1¼ to 3 inches outside diameter.

The Detroit Hexagon Drill Company of Detroit, Mich., are now making a line of special tools for the cutting of square and hexagon-shaped holes. These tools may be used either in the drill press, where the drill revolves, or in other machines where the drill is fixed and the work revolves. Tools of this type have been successfully used on steel, iron, brass, aluminum, micarta, bakelite, wood, marble, etc.

The Dauber-Kratsch Company, Oshkosh, Wis., has added a new type of drilling machine to their Wisconsin line. The all-geared mechanism is similar to their gear-driven 20 inch machine, which at present is being made up as two, three and four-spindle drills. The new design has a base of unit construction, so that machines of two or more spindles can be built up as desired and added to as occasion requires.

The Simmons Machine Company, of Albany, N.Y., are now manufacturing an open-side planer that will take care of work 42 inches wide, 48 inches high and up to 12 feet in length. The table is of the double-deck type and has three T-slots, the centre one running the entire length of the table. The column is of box pattern and amply reinforced with inside ribs. The L-shaped cross rail is designed to resist the severest strains and has a long bearing on the column.

A new manufacturing type of milling machine has been placed on the market by the Gabrielson Manufacturing Corporation of Syracuse, N.Y. The arbor support is an integral part of the frame, extending up from the front of the machine, this construction eliminating the need of an overhanging arm. The frame is of cast iron and made in one piece and supported on a base that is built as a tank for holding cutting compound. The spindle is hardened and ground, adjustable for wear, and runs in bronze bearings. These machines are built in three sizes, 6, 9 and 12 inches between the spindle and the table.

To meet the requirements of those manufacturers whose product calls for volume production from 3 and 4 inch bar stock, the National Acme Company of Cleveland, Ohio, has developed an automatic which is constructed on the multiple spindle principle so common in the smaller sizes. This machine makes it possible to complete all operations in the time taken for the longest cut. While the general design is similar to that of the smaller machines, many of the details have been modified to meet the needs of the larger product. Some of the factors that have been given special attention are: convenience of operation, minimizing the consumption of power, application of safety devices, simplification of design, and standardization of auxiliary appliances.

The Toledo Milling Machine Company has placed on the market a new type of vertical milling machine. The unit method of construction has been adopted so that the table, saddle or the knee may be quickly taken off and replaced and the feed-gear case may be taken off with the gears intact by the removal of six screws. A feature of the machine is the control of the different movements, which is carried out from the one operating position, and, by means of an engaging lever, the control of the table movements, lateral, cross or vertical, can be transferred to the centrally-located handwheel on the knee. Automatic disengagement of the feeds are provided. The spindle has eight changes of speed, ranging from 97 to 411 r.p.m. with open drive, and eight with the back gears, ranging from 18 to 76 r.p.m. Longitudinal movement of the table is 46 inches and the traverse 14 inches, and a vertical movement equal to the traverse. The spindle has a vertical movement of 6½ inches. The table surface is 56 by 14 inches. Total weight of the machine is approximately 7,000 pounds.

Some experiments are in progress, according to the "Aerial Age," on the effects in the process of brazing steel on long immersion—that is to say, from three minutes to one hour—in the bath of molten spelter. So far no deleterious effects have been noted. The steel gradually goes into solution at the rate of about 0.001 in. on each surface every two minutes. It has been found that the presence of dissolved iron increases the strength of the spelter. Experiments are being continued with traces of manganese in the spelter, and it is thought posible to obtain an ultimate strength of between 100,000 and 200,000 lb. per square inch for the brazed parts.

The Morse Chain Company, Ithaca, N.Y., announce that they have moved their South-eastern States office from Greensboro, N.C., to Charlotte, N.C. This has been necessitated by the great growth of the textile industry, who are large users of the Morse Company's product.

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PRINCIPAL CONTENTS

Where the Money Went

THE people of United States had a very practical demonstration of what a mess could be made out of so complicated a utility as a railway system.

The Government controlled the roads. They raised passenger and freight rates enormously, and then lost money in millions.

Here is what happened in an average month of 30 days:

"The earnings of 17½ days of each month were paid to labor in wages.

"The earnings of 3 days were paid for fuel.

"The earnings of 5 days were paid for materials and supplies.

"The earnings of 1½ days were paid out for taxes and equipment and facility rents.

"This consumed the earnings of 27 days of each month.

"The earnings of the remaining 3 days went to net operating income and were used by the Government to pay the guaranteed standard return to the companies. The net operating income was insufficient for this purpose and in consequence there was a direct levy on the Government to meet the deficit."

It is easy for agitators who have nothing at stake to paint a great picture of the corporation gouging the public, but it is quite another matter to make the same dear general public see and realize that they have been well and properly gouged by their flier into state ownership of railways.

Heat Treaters Organizing

HEAT treaters are forming an association in this district, and it is well that they should.

With the changing conditions in the mechanical world, with the enlarged use of alloys and special metals for special purposes, there is opening up a great field for the metallurgist and the specialist in heat treating.

Firms are beginning to see the need of being sure of what they are GOING TO GET, rather than experimenting with what they have got in order to see if it will stand the strain.

Firms in this district will be making a capital investment if they see to it that the efforts of the heat-treaters to unite for scientific advancement are not allowed to sag by reason of poor financial support.

Sugar and the Mechanic

PRICES of sugar, according to reports, jumped to 22 and 25 cents per pound in London and Hamilton respectively.

And if wages do not jump in proportion the man who must buy is short that much and he comes back on his employer.

The price tinkers have something to answer for in keeping the agitation up for more pay.

The price of a pound of sugar is of supreme importance to the mechanical world, because the jumping price of a pound of sugar makes the mechanic constantly wonder if there is to be no end to this gouging business.

British Empire Steel

THE bringing to pass of a merger of Canadian Eastern steel and coal interests, transportation companies and shipyards, and the linking up of these with large British steel interests, is an important move in the development of Canada's natural resources.

It is also valuable as helping to bring the British and Canadian steel interests closer together. It will provide Canada with an opening to world trade in steel which her captains of industry could hardly hope to accomplish if left to their own resources.

The new arrangement will also end the litigation that has hindered and hampered the development of iron and steel is Nova Scotia and the Atlantic seaboard in general. There has been a lot of energy expended in that direction that can now be liberated and employed in more remunerative lines.

The development of steel and iron in Canada means the building up of a substantial, basic industry, and the linking up with British finishing capacity, distributing organizations and financial strength means the elimination of much of the risk and uncertainty that would attend the venture if undertaken under less substantial auspices.

"Free Press Evening Bulletin (Winnipeg)
What do Canadians think about it?

The Romance of the Advertising Pages

By F. A. McLean

LAYING aside for a moment the usual dollars and cents angle of advertising, have you ever stopped to consider the advertising pages of your magazine or trade paper from their human interest point of view?

Now an advertisement is just as much a news item as a notice in your home town paper that Sallie Jones was married in a red hat and that she is going to live in Podunk after the honeymoon, or that Bill Bailey lost three fingers last Friday while trying to clean the teeth of a buzz saw and swears that next time he tries it it won't be on a Friday.

The ads. tell you who, why, where, when and what and they come mighty close to us because they speak in a language that we know, the language of our hobby or our business.

Many of the brightest lights of our modern literary world are not too proud to write advertisements, or our famous artists to illustrate them. Where but in the advertising pages can we find finer examples of that almost extinct art of the etcher and the wood engraver?

Advertisements must compete for attention with the news pages, editorials, the stories, the articles and the pictures in the body of the magazine or the trade paper. Hence nothing is too good or too costly to illustrate the ads., which are often the finest examples of the best work of our photographers and photo engravers to-day.

So fine are some of these illustrations, and so beautifully worded and illuminated the texts, that they rank with the best in literature and art that have come down to us through the ages. In the colored inserts of our magazines we find reproduction of cakes, candies and other goodies, so resplendent and so natural that our mouths water, figures and faces of men and women so natural that we want to smile or cry when they do, look to see what they are looking at, gloves and clothing so realistic that we feel like picking them off the pages and putting them on, etc.

Let us imagine what we could do, you and I, if we had an Aladdin's Lamp and could bring all of the people shops, machines and other products out of the pages of a single issue of Canadian Machinery and place them along a single city street.

Wouldn't it be a tremendously long street, and how interesting it would be to go down one side of this street and up the other, looking at all the wonderful array of people, shops and goods displayed? Just think how much we could probably learn with little or no trouble in a single trip.

Or let us shift the scene and let's pretend for a few minutes that we are back in the middle ages, and that each one of the ads. represents a town crier or a roadside stand. What an experience it would be to walk along listening to this great army of criers calling our attention to their masters' goods in all the varying tones, high, medium and low, which such a throng might be expected to use!

Or coming nearer home, let's go back a few years to the time we pitched marbles in the streets or played "Chaw Raw Beef" by the "Ole Swimmin' Hole," and imagine a circus coming to town—and such a circus as it would be if all the ads. could come to life and all their characters and products step down from the printed pages and form up in the ground parade!

How we, and other youthful "Captain Kidds," Jesse Jameses, and "Rain in the Faces" would have followed that parade and how quickly would the elephant, the clown, the painted lady and the fat man have been forgotten amidst such an array of wonders!

When you read the ads. you gain the pleasure and profit of clear thinking and store up in your memory for future use, for yourself or your friends, the endless supply of interesting and valuable information they contain.

Read the advertisements in your magazines, your newspapers, your trade journals—for the news they contain—for their educational value—for the life, vitality, art, wit and humor to be found in them—to raise your ideals and to guide you in your family and business affairs.

Here is what I found in a recent issue of CANADIAN MACHINERY:

Why I need a good die stock if I need one at all.

The story of a drill which worked for a piano company for two years without any trouble.

Some interesting facts about a town in Quebec.

How fast a hack saw should cut when in proper condition.

The solution of a brass working plant's cleaning problem.

What Canada's steel mills are making.

The clutch I should use for the place that's hard to get at, or where space is scarce.

The tale of a miller that keeps five die-sinkers busy and has been doing it for four long years.

The kind of machinery that should be used to grind parts with accuracy and despatch.

Vanadium and its effect on steel.

A metal that has mastered all other metals.

The kind of tools that are used in Canada's great logging camps.

The story of Mr. Punch and his fifteen hundred good tools.

The why and the wherefore of goggles in industrial plants.

A method by which drilling time may be cut from 20 to 2 minutes.

How motor truck makers grind their shafts.

A belt that will stand up under steam without going to pieces.

Why Gisholts are so successful.

One method that enabled a manufacturer to increase his production by 220 per cent.

A little detail in the construction of a wire fence that makes it stand up well.

The furnaces in which nichrome, the master of oxidation and heat, is made.

A conveyor belt that gives exceptional service because it is built like an automobile tire.

A means of cutting down overhead expense by using the right kind of hoisting and handling equipment, and many equally interesting and helpful pieces of news, human interest stories, etc.

MARKET DEVELOPMENTS

Steel Prices Not Raised for Third Quarter

Formation of New Combination of Canadian and British Companies Attracts Much Interest—Deliveries Do Not Improve, But Prices Are Not Jumping as Formerly

INTEREST centres in the steel world on the prices for the third quarter booking. It seems likely that the Steel Corporation will adhere very closely to their old schedule, which keeps the price down to the market of March 21, last year. Some of the independents and premium mills are selling now without difficulty at 50 per cent. above the Corporation prices, and there are many individual instances where much higher figures have ruled.

The bringing together of the various Canadian and British interests concerned to form what will probably be called the British Empire Steel Corporation is attracting no small amount of attention in trade circles this week. That Canadian mills on the Atlantic seaboard shall make semi-finished material and ship to the finishing mills of the Old Country, thus getting the use of their great distributing agencies, opens a big field.

There is a monotonous sameness to the situation now. Week after week dealers and consumers have the same story. Deliveries bad, worse, or indifferent. Prices jumping and uncertain. And in spite of all these, there is still a large amount of business in the market, although it is certain that some projected industries are holding back to see what the future is going to bring forth.

There is not much on the surface in the way of May-day troubles, but there are many rumors of strikes and walkouts, and there are some industries where such a happening would mean that there would be a shut-down with no effort being made to operate.

MONTREAL MARKET MAY FEEL BETTER AFTER THE FIRST OF MAY

Special to CANADIAN MACHINERY.

MONTREAL, April 22.—Commercial and industrial interests here are hoping for some relief to the irregular delivery of materials that has been a feature of the trading during the past few months by the opening of navigation on the St. Lawrence, which is now practically in effect, the river having cleared of ice during the past few days. During the past week or more the general steel situation, both here and in the States, has been more or less affected by the strike that has been in force on American railroads. While not general in character, the resultant disorganization was sufficient to place a serious handicap on other lines of activity as it aggravated a condition that has been none too good for many a month, namely, the transportation of materials. Many steel mills, which, in the past have experienced considerable difficulty in obtaining material for normal production, were compelled to curtail their operations, and in consequence other industries depending on steel for their existence were affected in a proportionate degree. Dealers here, who a few weeks ago were optimistic regarding the spring outlook, are again troubled when faced with conditions that now confront them. Warehouses are still low in standard lines and no definite promise can be obtained from producers relative to the delivery of material on order. Some dealers are able to get ample material for the urgent needs of regular customers, but little is available for emergency operations. In some instances the offer of premiums will bring forth the material, but frequently even the show of real money is not always followed by the delivery of supplies. It is almost impossible to get a dealer to make a prediction for the early future as they invariably state that it would only be a guess at the best, and the opinion of one is, well, just one man's opinion. The present uncertainty is increased with the near approach of the first of May when the habitual demands of labor are most pronounced. While little trouble of an extensive character is anticipated one can never tell just what might happen. The supply of sheets and tubes has shown slight improvement but not enough to provide a surplus over the existing requirements. Prices quoted in this district are unchanged as dealers state they are as good as any other under existing conditions, where price is a question of supply and delivery.

Supplies Difficult to Obtain

The feeling that May Day may develop additional demands from labor has had the effect of disturbing the general trend of business, not that the demand for equipment has shown any material shrinkage, but rather that the buyers are operating in a more conservative manner. The possibility of higher prices is not the only deterring factor, as the uncertainty of delivery is still the problem that prevents a more liberal placing of orders. The greater volume of trade done by machine-tool dealers, at present, is in the way of supplies. When it is possible to obtain the class of material asked for, dealers report a good turnover of business, but in many instances the filling of orders is accompanied by considerable difficulty in locating the supplies required by the customer. A certain manufacturer here requested a dealer to secure for him some special high-speed drills for drilling through an extra thick piece of metal. The town was apparently "dry," and it was several days before the dealer could obtain the desired article, and even then some grinding of the shank was necessary to meet the manufacturer's requirements. This condition virtually applies to many lines. A maker of rawhide gears here has been unable to obtain rawhide for nearly six months. The demand for all classes of supplies is a feature of present trading; the price is generally high but more frequently of secondary consideration.

Dullness in Scrap Trading

There is little to be said in regard to scrap other than the situation remains about the same with a steady movement of material. Buying has not improved but the demand for cast iron scrap is heavier than supply will accommodate. Local dealers are trying to meet the needs of the situation but the marked scarcity of scattered supplies is pronounced in the poor returns of the smaller dealers. Non-ferrous scraps are not active and weakness is increasing, although dealers refrain from changing prices as now quoted, stating that these are only nominal at the best.

THE STRIKE MAKES WORK HARDER HERE

Buyers Who Have Been in U. S. Markets Find No Help There

TORONTO.—The various strikes that have been staged in the U. S. are begining to have their effect on deliveries to a rather serious extent. This is particularly the case where manufacturers are bringing in certain parts from that country to be used in turning out the product, the rest of which is made here. A number of cases are reported where cancellation of sales has taken place on account of the inability of the maker to get the goods out on time.

There is also a feeling of uncertainty on both sides of the line as to what may or may not happen on the first of May this year. There are plenty of rumors around of strikes and walkouts, and it would not take much of this sort of thing to make the going pretty doubtful in several lines.

Delivery schedules are still well into the future in many lines of machine tools. Firms delaying the placing of business find that they cannot get attended to for some months now and are inclined at times to drop their whole idea of extension or renewal or equipment. Dealers attribute much of this—and they are no doubt right—to the fact that manufacturers do not plan the placing of equipment far enough ahead in order to give the machine tool man a chance to give him good service.

The Trend of Prices

Some speculation is going on in steel circles as to where the U. S. Steel Corporation will place their prices for third quarter booking. Indications seem to be that the price will be very close to that prevailing at the present time. The prices have been announced for a good many of the mills in the United States, and the price here hinges largely on whether the U. S. firms consider Canadian business as being domestic or export. The claim is that the former is the rating but there is some difference among the Canadian dealers.

One selling agency representing mills outside of the corporation gave the warehouse interests in this district a price of black sheets last week, and the first of this week notified them that in case they were considering buying they would have to pay $10 a ton more. There are cases where the independents and the premium operators are selling at about 50 per cent. above corporation prices, and the trade is hard pressed for an explanation. They begin to figure that either the independents are too high or the corporation too low, and there is not much danger of the latter being the case.

There is probably good reason to believe that the corporation will be in a position to cash in later on the goodwill that it is creating at the present time by reason of the moderation of its selling price, which still holds closely to the schedule of March 21, 1919.

Got Little Encouragement

One Toronto buyer who spent ten days in New York and Pittsburgh returned with little encouragement of anything better on ahead. Conditions at the mills are not improving. They fear that more trouble may come to the surface on May 1st. The production costs are increasing, but with them there is nothing better in the quantity of material produced for the extra money. The railroad strike across the line has had the effect of making it hard for some of the mills to keep rolling. One very effective way to deal with the steel business is to interfere with the supply of coal or coke, and this was done.

Canadian mills seem to be holding the price of bar iron at the price announced some weeks ago now. Dealers are not anxious to see it go any higher, but it is worthy of note that in these days of hopping values the mills have kept the price of bar iron at the same figure for some six weeks or two months now.

A new list is out on wrought pipe, showing an advance. For instance, the old price for 1/8 inch was $6 against a new quotation of $6.50, with all others increased in proportion.

Small tools and supplies are selling in good quantities. Some of the orders coming in indicate that some of the smaller firms are resorting to buying in larger quantities than for some time. They apparently think there is little danger of values going down, and they are anxious to protect themselves as to price and delivery.

Scrap Market is Dull

Although several points in the States report prices on the scrap market as inclined to sag, there has been no reflection here on this as far as the actual quotation is concerned. Consumers are not tempted to come into the market because they hold in many cases that the prices demanded by the yards for their holdings are too high. The yards are firmly of the opinion that lower prices are not coming for the present, and they are standing pat on their figures. In such an atmosphere where it is a hard matter for buyer and seller to get together, and that is exactly how it is working out—they are staying apart.

POINTS IN WEEK'S MARKETING NOTES

The machine-tool trade in New York is reported good, but with possibilities of a strike on May 1 interfering seriously with production.

The possibility of labor trouble on the first of May is causing uneasiness on both sides of the border, and the various strikes which have already occurred in the United States are having a serious effect on deliveries.

U.S. Steel prices for third quarter delivery are forecast to be very close to that prevailing at the present time.

A new list is out on wrought pipe showing an advance for all sizes.

The scrap market is in a comatose condition owing to the inability of buyers and dealers to get together over prices.

The striking switchmen at U. S. points have also interfered with the scrap iron market, no real prices being quoted and scrap in many cases being hung up in the yards.

Pig iron shipments have also been stopped for the same reason.

NEW YORK FIGURES ON MACHINISTS' STRIKE

And Many Plants Claim They Will Shut Down As Conditions Are Only Fair Now

Special to CANADIAN MACHINERY.

NEW YORK, April 22.—Despite the extreme difficulties confronting the industries of the East during the past week or ten days, resulting from the strikes of railroad workers, a very good business in machine tools has been done. Moreover, the metal working industries are facing a possible strike of machinists on May 1. Demands have been presented by the International Association of Machinists, which it is believed employers will not accede to, and the result may be further industrial paralysis.

In the East 40,000 machinists will go out, according to union officials. All machine shops, shipyards and other places where machinists are employed will be affected. Other sections of the country will likewise be affected.

The demands of the machinists are for $1.10 an hour for toolmakers, $1 for machinists, and riggers, 80 cents for specialists, 75 cents for helpers, 60 cents for women helpers, 30 cents for apprentices during the first six months and 40 cents for six months thereafter, 50 cents for the second year, 65 cents for the third year and the regular minimum thereafter; double time for overtime, thirty minutes intermission before overtime and single time during this intermission; the closed shop; night work to consist of forty hours' work during five nights and 25 per cent. over the day rate to be paid for night work.

It is almost certain that the metal working industries will not accede to these demands, especially to the closed shop. There is some talk that many industries, in the event of a strike, will make no effort to operate. They have been seriously hampered by car shortage, scarcity and high prices of raw materials and the general apathy of labor, and would prefer, in some cases, not to attempt to run under the added burden which a machinists' strike would impose.

The railroad embargoes have caused an even greater shortage of raw materials, and some plants have temporarily laid off a part of their working forces.

Among the Eastern manufacturers who have bought machine tools in the past week are the Willys Corporation, Elizabeth, N. J.; the Van Sicklen Speedometer Co., Newark, N. J., and Toledo, Ohio; the Simms Magneto Co., East Orange, N. J.; the Singer Mfg. Co., Bridgeport, Conn.; the Lehigh Valley Railroad.

WOULD RATHER WAIT FOR MARKET CONDITIONS TO MAKE FRESH START

Special to CANADIAN MACHINERY.

PITTSBURGH, April 22.—The dominant factor in the iron and steel situation has been the rail strike, which curtailed production quite largely and at the same time put a damper on the market. The movement of Connellsville coke was entirely stopped, except for some shipments East. Production was not curtailed in like proportion, but was cut down by more than one-half. At the beginning of last week the rail strike was practically at its height, but there was a fair supply of empties, and day by day the railroads were able to dig up a few more, so that there was some producing and shipping. This was not a movement of coke, however, as the loaded cars got no farther than the yards, and some merely got on to sidings. The by-product coke ovens had hardly any coal, and their shipments were almost entirely suspended, so that altogether but little coke was available for furnaces in the regions affected by the strike. Some of the stacks, however, had stocks of coke laid up against any emergency that might arise, so that the curtailment in pig iron production has been only about one-third of the production and perhaps not altogether as much as that.

In the Youngstown district the situation has been worst, as the mills there have received scarcely any coal, and all are practically down except one or two that had stocks of coal. In the immediate Pittsburgh district there have been some works closed, but the larger works have limped along.

For several days the strike has been waning, but it will be a week, at best, before the coke works, blast furnaces and steel mills have regular rail service again. The roads affected had to get their passenger trains running first, and then they paid attention to foodstuffs and perishables. All told, the loss of production may run not much less than half a million tons in both pig iron and steel ingots.

Divergent Sheet Prices

Since opening its order books Tuesday of last week, as noted in past report, the American Sheet & Tin Plate Company has been entering tonnages from regular customers for the second half with manufacturing consumers and for the third quarter with jobbers. The selling really consists in allotting tonnages, the customers having no hesitancy in taking the tonnages allotted, on account of the price. Even now the independent sheet manufacturers show no signs of modifying their sales policies by reason of the leading interest opening its order books for the second half. All the independents have had higher prices than the leading interest, and none has thus far showed any disposition to book at the basis prices. The independents cannot, of course, sell to the end of the year at premium prices, and they would rather get premiums while the premiums last, particularly as there is no definite evidence that the premiums will not continue for a long time. There is nothing like uniformity of price among the independents, the delivery time determining the premium, several cents a pound for deliveries in the next few weeks, down to say half a cent a pound for August or September delivered, and mills that cannot make earlier delivery than that do not seem anxious to book any tonnage at all.

Tin plate stands in an entirely different category, as the great majority of independents will book their regular customers at least at the regular price of $7 per base box. Doubtless, however, more tonnage will be saved to sell in the prompt market, at premiums, than was the case when contracts for the present half year were made.

Bars, Plates and Shapes

The large independents making bars, plates and shapes, have not, as a rule, opened their order books for third quarter deliveries, and apparently they have doubts whether they could sell all their tonnage for third quarter at the prices they have been asking of late, say 3 cents for bars, 3.10c for shapes and 3.25c for plates. For very early delivery much higher prices are obtainable, 4 cents for bars being far from uncommon, so that there is a natural temptation to hold off in hopes of securing higher prices by waiting. Buyers in general show an indisposition to make any commitments for delivery beyond July 1, unless at basic prices, the prices of the Industrial Board schedule of March 21, 1919, to which the Steel Corporation has steadfastly adhered.

A Quiet Market

The rail strike and the divergence in prices between the Steel Corporation and independents are strong factors in making the market as quiet as it is, but there is good reason to suspect there are other causes. There is a widespread fear that industrial and financial conditions will not be satisfactory a few months hence, and there is good reason for that fear when one considers that the conditions are not satisfactory now. Money is extremely tight, even on Liberty bonds and real estate mortgages. Everybody is busy, although some workmen are busy holding their jobs rather than striving for maximum efficiency, but nearly all along the line there is the feeling that the activity is only temporary. Factories that are busy filling orders, many being far behind on orders, do not feel certain that they will continue busy. This does not mean that there is clearly discerned trouble ahead, but that it is impossible to see for certain whether or not there is going to be trouble, hence throughout industry there is a feeling of conservatism. As soon as the future can be foreseen with more certainty business will make a fresh start.

Pig Iron Firm

All the appearances are of pig iron being very firm. Furnaces are altogether indisposed to cut prices, while in the case of foundry iron sales are being made at prices higher than the figure formerly accepted as defining the market in general. There is, however, practically no buying for second half, and as pig iron still remains somewhat scarce, at least there is no difficulty in securing full prices and sometimes premiums on the small lots that are sold for early delivery. Bessemer remains at $42 valley, basic being generally quotable at $41.50 valley. Foundry iron, however, is quotable at an advance, on a sort of technical basis. Formerly, the chief sales were for second half, at $42 valley, and that was the quotable basis of the market, sales of prompt at higher prices being regarded as involving a premium for the delivery. Now, however, there is no second half business going, and sales of prompt continue at $43 to $44, valley. As these are the only sales made they represent the market, which is thus quotable $1 to $2 higher than the old quotation.

Galt Foundry Extends. — The Galt Brass Company has started work on two additions to their plant, at an estimated cost of $50 000 The foundry building will be 60 by 140 feet, and the other 40 by 50 feet.

U.S. SCRAP METAL

Strike Also Has Its Scrap Market

The striking switchmen have pretty well demoralized the scrap iron market, and some small dealers who have considerable money tied up in material which is on the road, are feeling the pinch financially. From every district in the United States the reports are of markets from which all interest has departed. Under the circumstances there are no real prices to be quoted, though most grades have gone off to some extent. In Chicago, Pittsburgh and St. Louis the railroads have heavy lists of old material to offer. The underlying situation is good, but till the transportation situation is improved, the market will continue to suffer.

PIG IRON TRADE

Strike Holds Up Pig Iron Market

The strike on the railroads has had the effect of suspending shipments of pig iron almost entirely. Consumers have to depend on the stocks they have in their yards, while furnaces are piling iron. In the Pennsylvania region the shortage of fuel has compelled many furnaces to bank, as they have had but little reserve to draw from. There was a good volume of business transacted in this district during the week, despite the handicaps. Eastern Pennsylvania iron is at a base price of $45 for No. 2 plain, while in Central Pennsylvania the base price is $43 to $44. Chicago reports tell of a very quiescent market. Transportation is tied up by the strike, and there is practically no trading. Foundries are getting along as well as possible with the stocks they have on hand. Pittsburgh is experiencing a large volume of enquiry, though the tonnage actually closed falls below the enquiry figures considerably. Enquiries for basic iron for the second quarter of the first half amount to about 20,000 tons. Some of this was expected to be closed at $43 valley furnace. Foundry iron for prompt delivery has been done at $45 for No. 2 foundry in this district. The market in Cleveland had been showing a more active spirit up till the time of the strike, but with the cutting off of shipment and the sudden stoppage of fuel supplies, there was a cessation of trading. Some of the furnaces may be compelled to bank, while there are others which are in a fairly good position as far as fuel is concerned. Prompt iron which was being offered at $42 valley is now $44 valley. There is a good enquiry for basic and $43 is the average price at the furnace. The situation in New England, according to reports from Boston, shows a sudden stagnation following in the wake of the strike. Everybody's efforts have been turned to getting deliveries, and the trading has been neglected. Foundries are operating on a very narrow margin of supplies, and at least one has been closed down. Prices are irregular. From New York the reports are better, both actual sales and enquiry having been good. There have been several sales for export of both foundry and basic to Europe and there is a fair demand from this quarter. Foundry iron is at about the same price as last week. There has been little business done in Buffalo, and that mostly for first half delivery, at the $45 base price for foundry iron. St. Louis and Birmingham report a fair amount of selling, mostly in small lots. Cincinnati reports a strong market and considerable second half iron has been sold. No. 2 Southern iron is at $43 to $44 for either prompt or second half delivery.

BRINGING THEM BACK TO LIFE

How to bring back to life people who apparently are dead from drowning, gas asphyxiation, electric shock or a sudden severe blow is told in simple, direct language with photographic illustrations in National Safety Council Bulletin No. 910. The Prone Pressure method of resuscitation described in detail in this bulletin should be taught to every man, woman and child, for its application—if prompt and efficient—will save lives in situations likely to be met in any industry and in any walk of life. The opportunity to save a life by the intelligent use of the Prone Pressure method comes at least once in the life of nearly everyone.

Classes Practice Resuscitation

A rapidly increasing number of employers are now teaching and requiring their employees to practise the Prone Pressure method of resuscitation. The rules for practice are, of course, most rigid in departments where employees are most likely to be exposed to the danger of asphyxiation, electric shock, or drowning. Such instruction in most cases, is given in classes.

Employees who daily are exposed to these hazards should be required to practise use of the Prone Pressure method of resuscitation at least once a week and during the practice each workman should be required to demonstrate his ability by applying the method to a fellow workman. It is recommended that at least four times a year examinations be held to classify workmen into those competent to apply the method successfully and those incompetent to do so. Workmen who fall into the incompetent class should be given special instruction until they are able to perform the operation successfully.

Employees in departments where the hazards of asphyxiation, drowning, or electric shock are less frequent, should be required to practise the resuscitation method at least once a month. Every new employee should be taught this method within twenty-four hours after being put to work. Some companies require workmen to practise once a week until each man in the gang or division is proficient, after which practice is held on alternate weeks.

Every Employee Should be Taught

Many members of the council consider it desirable to offer instruction in this resuscitation method to all employees so that office workers and others, though having no direct contact with the hazard, may become proficient in the practice of resuscitation.

The increasing use of electricity and gas for light, heat, and power, and the increasing popularity of swimming, are constantly adding to the large numbers of persons exposed to the hazards of asphyxiation, electric shock, and drowning. The stopping of breathing from a sudden blow or physical shock may occur at any time and at any place.

It is no longer uncommon to hear of instances in which employees of public utilities saved the lives of other employees or of the general public by use of the Prone Pressure method of resuscitation. Unfortunately, however, we cannot always expect that employees of public utilities will be in the vicinity when the need for the application of the Prone Pressure method arises—hence the desirability of transmitting this knowledge and of affording opportunities to practise the method to as many men, women, and children as possible.—"National Safety News."

The American Gear Manufacturers Association will hold their fourth annual meeting at the Hotel Statler, Detroit, on April 29, 30 and May 1. An interesting programme has been arranged, some of the papers being "Gears from a Purchaser's Standpoint" by D. G. Stanbrough of the Packard Motor Co. through the Factory," by J. A. Urquhart of the Brown & Sharpe Manufacturing Co. "'The Science of Manufacturing" by Henry M. Leland, president of the Lincoln Motors Company. A visit will be paid to the Ford Motor.

Never make a contract like a jug, with the handle all on one side; be fair, for you cannot succeed in any other way.

The Lord will provide. John D. Rockefeller does not deny this, but says, "The Lord is very busy; I think we had better provide a fund."

Do a driving business, says the hammer.

Order is Heaven's first law. If we would have Heaven on earth, keep order.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$42 40
Lake Superior, charcoal, Chicago	57 00
Standard low phos., Philadelphia	50 00
Bessemer, Pittsburgh	43 00
Basic, Valley furnace	42 90
Toronto price:—	
Silicon, 2.25% to 2.75%	52 00
No. 2 Foundry, 1.75 to 2.25%	50 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 50
Steel bars, base, Toronto	5 50
Iron bars, base, Montreal	5 50
Steel bars, base, Montreal	5 50
Reinforcing bars, base	5 00
Steel hoops	7 00
Norway iron	11 00
Tire steel	5 75
Spring steel	10 00
Band steel, No. 10 gauge and 3-16 in. base	6 00
Chequered floor plate, 3-16 in.	9 40
Chequered floor plate, ¼ in.	9 00
Staybolt iron	9 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	4 00
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 90
Small shapes under 3"	3 62

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points	C.L.	L.C.L.
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

	Gross. Montreal	Toronto
Lake copper	$25 00	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	77 00	75 00
Spelter	12 50	12 25
Lead	12 00	12 00
Antimony	14 50	14 00
Aluminum	34 00	35 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 7 25	$ 7 25
Plates, ¼ up	6 50	6 50

PIPE—WROUGHT

Price List No. 44—April, 1920.

STANDARD BUTTWELD S/C

	Steel Black	Steel Galv.	Gen. Wrot. Iron Black	Gen. Wrot. Iron Galv.
¼ in.	$6 60	$ 8 60	....	....
¼ in.	5 13	7 26	$ 5 43	$ 7 66
⅜ in.	5 13	7 26	5 43	7 66
½ in.	6 84	8 42	7 27	8 84
¾ in.	8 45	10 68	9 03	11 16
1 in.	12 60	16 64	13 35	16 49
1¼ in.	16 91	21 16	18 06	22 31
1½ in.	20 21	25 30	21 59	26 68
2 in.	27 20	34 04	29 05	35 89
2½ in.	43 00	53 82	....	....
3 in.	56 23	70 38	....	....
3½ in.	71 30	88 32	....	....
4 in.	84 48	104 64	....	....

STANDARD LAPWELD S/C

	Steel Black	Steel Galv.	Gen. Wrot. Iron Black	Gen. Wrot. Iron Galv.
2 in.	$30 90	$37 74	$34 60	$41 44
2½ in.	45 34	56 16	51 19	62 01
3 in.	69 29	73 44	66 94	81 09
3½ in.	73 14	90 16	82 34	99 36
4 in.	86 66	106 82	97 66	117 72
4½ in.	0 98	1 23	1 24	1 49
5 in.	1 15	1 44	1 44	1 73
6½ in.	1 49	1 86	1 87	2 25
7 in.	1 94	2 43	2 42	2 90
8-L in.	2 04	2 55	2 54	3 05
8 in.	2 35	2 94	2 92	3 61
9 in.	2 81	3 52	3 50	4 21
10-L in.	2 61	3 26	3 25	3 90
10 in.	3 36	4 20	4 18	6 03

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.

4½" and larger 50%.

4" and under, running thread, 30%.

Standard couplings, 4-in. and under, 30%

Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices.

Per 100 Pounds.	Montreal	Toronto
Copper, light	$15 00	$14 00
Copper, crucible	18 00	18 00
Copper, heavy	18 00	18 00
Copper wire	18 00	18 00
No. 1 machine composition	16 00	17 00
New brass cuttings	11 00	11 75
Red brass cuttings	14 00	15 75
Yellow brass turnings	8 50	9 50
Light brass	6 50	7 00
Medium brass	8 00	7 75
Scrap zinc	6 50	6 00
Heavy lead	7 00	7 75
Tea lead	4 50	5 00
Aluminum	19 00	20 00
	Per Ton	**Gross**
Heavy melting steel	18 00	18 00
Boiler plate	15 50	15 00
Axles (wrought iron)	22 00	20 00
Rails (scrap)	18 00	18 00
Malleable scrap	25 00	25 00
No. 1 machine cast iron	32 00	33 00
Pipe, wrought	12 00	12 00
Car wheels	22 00	26 00
Steel axles	22 00	20 00
Mach. shop turnings	11 00	11 00
Stove plate	25 00	25 00
Cast boring	12 00	12 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜-in. and less	10
Carriage bolts, 7-16 and up	Net
Coach and lag screws	25
Stove bolts	55
Wrought washers	45
Elevator bolts	Net
Machine bolts, 7/16 and over	Net
Machine bolts, ⅜-in. and less	15
Blank bolts	Net
Bolt ends	Net
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square, blank	add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 50
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	25 and 5
Sq. and hex. hd. cap screws	22½
Rd. and fil. hd. cap screws... plus	17½
Flat but. hd. cap screws .... plus	30
Fin. and semi-fin. nuts up to 1-in.	20
Fin. and Semi-fin. nuts, over 1 in., up to 1½-in.	10
Fin. and Semi-fin. nuts over 1½ in., up to 2-in.	Net
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$60 00
Open-hearth billets	60 00
O.H. sheet bars	76 00
Forging billets	56 00-75 00
Wire rods	52 00-70 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 70
Cut nails	5 85
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¾
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 35½
British Manila rope	0 28
New Zealand hemp	0 28
Transmission rope, Manila	0 47
Cotton rope, ¼-in. and up	0 88

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net

410

MISCELLANEOUS

Solder, strictly	$ 0 40
Solder, guaranteed	0 43
Babbitt metals	18 to 70
Soldering coppers, lb.	0 62
Lead wool, per lb.	0 16
Putty, 100-lb. drums	8 30
White lead, pure, cwt.	20 00
Red dry lead, 100-lb. kegs, per cwt.	16 50
Glue, English	0 40
Tarred slater's paper, roll	1 30
Gasoline, per gal., bulk	0 35
Benzine, per gal., bulk	0 35
Pure turp., single bbls., gal.	3 60
Linseed oil, raw, single bbls.	3 00
Linseed oil, boiled, single bbls.	3 03
Sandpaper, B. & A.	List plus 43
Emery cloth	List plus 37½
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin, "D," per lb.	0 14
Borax crystal and granular	0 14
Wood alcohol, per gal.	2 70
Whiting, plain, per 100 lbs.	2 75

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes	32½
Can. carbon cutters, plus	20
Standard drills, all sizes	32½
3-fluted drills, plus	10
Jobbers' and letter sizes	32½
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	net
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus 20 to	40
Can. high speed cutters, net to plus	10
American plus	40

COLD ROLLED STEEL

[At warehouse]

Rounds and squares	$7 base
Hexagons and flats	$7.75 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	60	75
Class B	27	37
Class C	18	27

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 8 50	$ 9 50
Sheets, black, No. 10	8 50	9 00
Canada plates, dull, 52 sheets	8 50	10 00
Can. plates, all bright	8 60	9 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	11 00	....
Fleur-de-Lis, 28 B.W.G.	10 50	....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28	....	....
Premier, No. 28, U.S.	11 50	10 50
Premier, 10¾-oz.	11 50	10 90
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅝ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	29 50
1¾ in.	31 50	30 00
2 in.	30 00	30 00
2¼ in.	35 00	29 00
2½ in.	42 00	37 00
3 in.	50 00	48 00
3¼ in.	.. ..	48 50
3½ in.	63 00	51 50
4 in.	85 00	65 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	24½
Palacine	27½
Machine oil, per gal.	43½
Black oil, per gal.	18½
Cylinder oil, Capital	82
Cylinder oil, Acme	70
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	$2 60
Union thread cutting oil, antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil, bbls., net	13½

BELTING—No 1 OAK TANNED

Extra heavy, single and double	10%
Standard	10%
Cut leather lacing, No. 1	2 75
Leather in side	2 40

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 60
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	09
Pumice, ground	06
Emery glue	30
Tripoli composition	09
Crocus composition	12
Emery composition	10
Rouge, silver	60
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE

XXX Extra	.24	Atlas	.20
Peerless	.22½	X Empire	.19½
Grand	.22½	Ideal	.19
Superior	.22½	X Press	.17½
X L C R	.21		

Colored

Lion	.17	Popular	.13
Standard	.15	Keen	.11
No. 1	.15		

Wool Packing

Arrow	.35	Anvil	.22
Axle	.28	Anchor	.17

Washed Wipers

Select White	.20	Dark colored	.09
Mixed colored	.10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades... 15%

ANODES

Nickel	.58 to .65
Copper	.38 to .45
Tin	.70 to .70
Zinc	.18 to .18

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6 x 4 base	45 00	44 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 75	$14 50
Sheets, 3½ lbs. sq. ft.	10 50	14 00
Sheets, 4 to 6 lbs. sq. ft.	10 25	13 50

Cut sheets, ½c per lb. extra.

Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .23
Acid, hydrochloric	.03¼
Acid, nitric	.10
Acid, sulphuric	.03¼
Ammonia, aqua	.15
Ammonium, carbonate	.20
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, annhy.	.41
Copper, sulphate	.16
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.08
Nickel carbonate	.32
Nickel sulphate	.19
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.25
Silver nitrate (per oz.)	1.20
Sodium bisulphate	.11
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.18
Tin chloride	1.00
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated

Canadian and British Interests Combine

Nova Scotia Steel & Coal, Dominion Steel Corporation and Canada Steamship Lines Come to Understanding With Some of the Big Steel Finishing Industries in England

THE name British Empire Steel Corporation gives some idea of the scope of the amalgamation of Canadian and British steel, coal and transportation interests, about to be consummated. The Canadian companies interested are, for the present: Nova Scotia Steel and Coal, Dominion Steel Corporation, and the Canada Steamship Lines, and in turn the shipbuilding yards on the Atlantic coast, the St. Lawrence and the Great Lakes. Transportation is one of the greatest problems of the steel trade, the carrying of iron ore, coal or coke and the taking away of the finished or semi-finished products being no small problem. It is thought that by this combination of activities the solution of the question will be made less difficult.

The Nova Scotia and Dominion interests have had conflicting problems in the way of iron and coal deposits for some time. There is now before the Nova Scotia House special legislation seeking to allot these claims on a basis of the actual needs of the companies. This legislation, it is thought, will, in view of the merger, simply be forgotten, as the combining of the interests will iron out many of the difficulties that have arisen in the past.

From what CANADIAN MACHINERY can learn, the companies will operate as separate units for some time at least, but their policies will be directed from the one office, and in this way they will be able to curtail considerable overlapping at the outset.

From the very nature of the location of the steel companies, and the understanding that has been arrived at with the finishing mills of the Old Land, it is apparent that export trade will be the big aim of the new corporation.

Col. Morden's Explanation

Col. Grant Morden, a Canadian financier who has taken a keen interest in British affairs recently, and who is a member of the British House, has had much to do with arranging the details and securing a basis from which the various interests could work. He appeared at Ottawa recently, and laid the plans before a group of members of the House and Senate. He went so far as to declare that the plans were for the formation of the greatest industrial organization in the British Empire. Some of his statements follow:

As I surveyed the industrial field in England, I looked back over the past years and their developments. I was rather under the impression that the great mercantile marine of England, having the supremacy of the seas, had made possible, to a large extent, the great industrial success of England, but I found this was not so. I found that it was only a contributory feature.

It was coal and iron, coal and iron, that made this success! It was coal and iron that made it possible for ships to go out loaded to the four corners of the earth to bring back cargoes necessary for England, but in every case, to leave a margin of credit in every place that ship went, and this margin kept on growing and growing the world over.

I found that the basic industry of England was steel; in fact, it is the basic industry of the world to-day, and I said to myself, this, then, is where we should start in building up a real Empire industrial partnership.

On the Atlantic seaboard of Canada lies the greatest deposit of ore and coal known of in the world to-day. There are over 5,000 million tons of iron ore, fifteen per cent. of the total estimated iron ore in the world, lying there; and side by side with it, is over 6,500 million tons of coal, all lying at tide-water with some of the finest harbors in the world. Consequently, steel should be manufactured there cheaper than in any other part of the world.

The geographical location is unique. It sits up over the North Atlantic ocean; it is closer to South America than the United States; closer to South Africa than England; a ferry service could be run across to the Clyde. But what is lacking? Two things—capital and experience!

I happened to be associated with some of the largest steel masters in England. I went to them and I said, you have the capital, you have your great finishing mills in England, you have your established connections in the markets of the world, but we have in Canada the raw materials, and we can make you your slabs and your billets much cheaper than you can produce or secure them in any other place. They agreed, and so have made possible the plans which we are now completing for the formation of the greatest industrial organization in the British Empire.

U. S. Steel Corporation Plans

Col. Morden also intimated that while in New York recently he had met the head of one of the greatest steel companies in United States. "He came to me," said Col. Morden, "the other day in New York and stated to me that he was well acquainted with the great ore and coal deposits of Newfoundland and Nova Scotia, but he said that no Canadian concern could make a success of itself in making steel for export trade. He pointed out that it had been necessary to get the Government at Washington to pass special legislation changing the Sherman law so as to enable all the great steel companies in United States to come together to form one export company to handle their export steel trade. He said that if it was necessary for them to do this in the United States to meet the competition of the world's markets, what chance would a Canadian company have, who could only manufacture a few lines of steel, against the combined resources of the great American corporations?"

In short, the Canadian steel companies in the East have linked up with the British interests that made it necessary for the United States Steel Corporation to come into existence in the first place.

The Week's Events in Montreal Industry

Repairs to the broken syphon beneath the Lachine Canal is progresing so favorably that the reopening of the waterway is anticipated about the first of May.

* * *

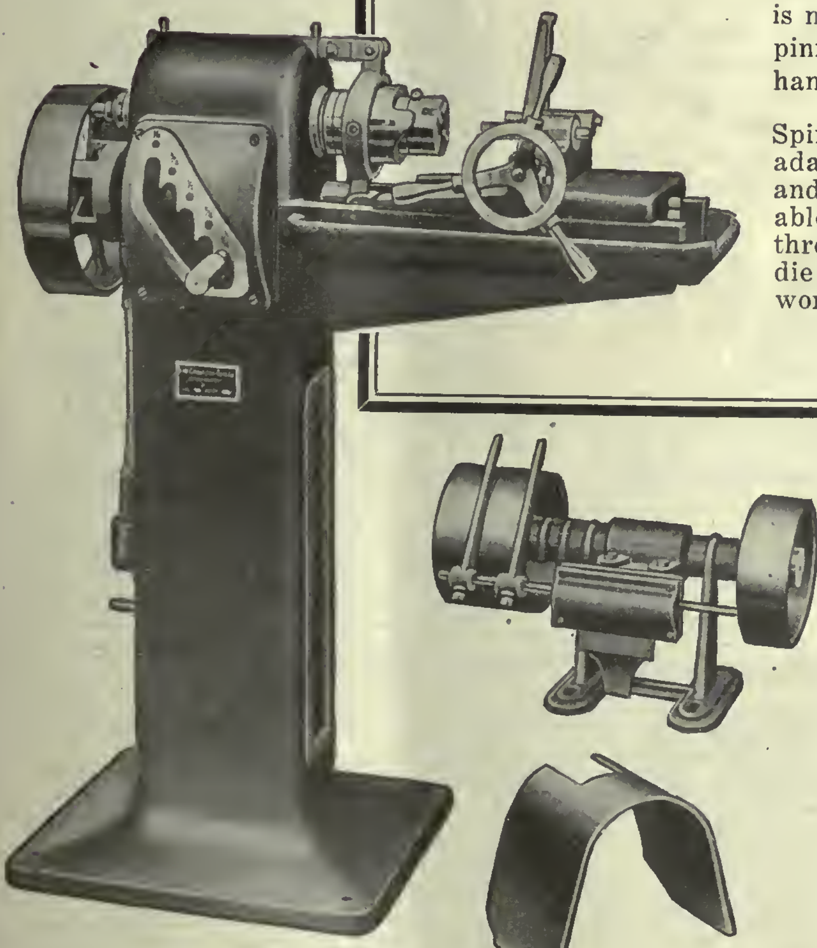
Capt. R. C. Brown, O. B. E., the newly appointed Deputy Warden of the Port of Montreal, has assumed the duties of the office, having arrived in Canada on the last trip of the Cassandra, of which vessel he has been in command for the past seven years.

* * *

The work of regulating the flow of the St. Maurice River, by means of the Gouin Dam, was described at last week's meeting of the Engineering Institute of Canada by Mr. O. Lefebvre, the chief engineer of the Quebec Streams Commission. The work, says Mr. Lefebvre, had proved a great success, a total of 400,000 horse-power being developed on the St. Maurice River, with the possibility of an additional half a million more.

* * *

The British Manufacturers' Association, through their representative, Rafael de la Cova, who has recently come to Canada, is endeavoring to improve trade conditions between the two



countries. Several conferences have already been held between Mr. de la Cova, the Board of Trade, and other business interests. In addition to his tour of Canada, Mr. de la Cova will visit many other countries in the interest of British trade development.

* * *

The appointment of consulting engineers by both the Canadian and American Governments marks a further step in the development of plans for the deepening of the St. Lawrence River between Montreal and Lake Ontario. Canada's representative will be W. A. Bowden, B.A.S.E., M.E.I.C., chief engineer of the Railways and Canals Department. Lt.-Col. Wooton, an engineer in the American Government service, will be the United States' chief consultant.

* * *

An extensive suite of offices in the Ottawa Building, Montreal, has been taken over by the British Trade Commission for Canada to provide more adequate facilities for gathering and distributing information to both Canadian importers and exporters, and also to British trade emissaries visiting Montreal. A large sample room and well-equipped library of Empire wide trade and technical papers has been provided for the convenience and education of business patrons.

* * *

The St. Lawrence Welding Company of Montreal has just about completed the new addition to their plant and recently purchased equipment will be installed within a week or so. In addition to their general line of welding and boiler work the company will be in a position to take care of every line of engineering work. The boiler and tank end of the business will be in charge of John Murphy, who has had 43 years of continuous experience in boiler work. He was four years with the Hall Engineering Works, two years with Burland and Johnson of Amherst, N.S., and thirteen years as foreman with J. & R. Weir of Montreal.

* * *

At a recent meeting of the Dominion Council of the Canadian Engineering Institute of Canada, held at the headquarters in Montreal, the question of revising the remunerative scale now in force was the chief subject of discussion, and, as a result of this meeting, it is expected that the executive will take some action regarding the economic welfare of the individual members of the society. It was pointed out that the Engineering Institute was in no sense a union, but a body of Canadian professional men, organized to carry out its work so as to advance the professional interests of the members, by means of papers and addresses, and in other ways, including such attention to material conditions as might be warranted.

Making Accuracy A Marketable Commodity

THERE'S a toolmaking shop in Detroit that refused to be stumped by any of the many problems our motor car builders present—the Michigan Tool Company.

This concern is fully equipped for any job—which means Dumore Grinders are there to do their bit.

In building jigs, standard bushings are used, the outer diameters running in an ascending series of sizes and calling for an arbitrary "constant" for the press-fit.

For grinding of this kind the Dumore is the ideal tool—high speed, dynamically balanced, non-vibrating, easy to move out of the way to permit the various holes to be indicated.

Write for information.

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PERSONALS

A change of management is announced by the Robb Engineering Works of Amherst, N.S., by which Mr. D. W. Robb, who has been engaged in the active management of the concern for the past forty-five years, now takes the position of vice-president. In a circular letter Mr. Robb states that the company are taking up new lines, including the development of farm tractors. The new manager of the company will be Mr. George E. Newill. Mr. Newill received his engineering training in England and has had considerable engineering and business experience in Canada and other countries. Mr. Robb will continue to act in an advisory capacity.

STARTS NEW COMPANY

Chas. Watt, who has been associated with the Geo. F. Foss Machinery and Supply Company for the past two years, has opened an office at 212 McGill St., Montreal, and will carry on business under the name of the Watt Machinery and Equipment Company. Mr. Watt has had a wide experience in machine and engineering matters; he was born on June 15, 1877, in the town of St. Louis, Que. His early years were spent on the farm of his father, but at the age of 18 he came to Montreal and started his apprenticeship with the John McDougall Caledonia Iron Works. After five years with this firm he worked eighteen months with the Laurie Engine Company and from there he went to Dundas,

CHARLES WATT

working for John Bertram and Sons for two years. He then returned East to Peterborough and served with the Peter Hamilton Company for two years. In 1903 he started with the Dominion Bridge Company of Montreal, working there for ten years, the last eight as foreman. From 1913 to 1915 he was engaged in real estate activities. Early in 1915, when the demand for munitions became excessive and when executives were urgently needed, he was appointed superintendent of the shell department of the Canada Stove and Foundry Company at St. Laurent, retaining this position until 1918, when he became a salesman with the Geo. F. Foss Company, leaving there on March 15 last to open an office of his own.

Car Plant to Start.—The Canadian Car and Foundry Company at Fort William expect to have their plant in operation on the 3,000 cars for the Canadian Pacific Railway by June. The Company are taking on men at present to complete rush repairs on 1,500 cars for the Canadian National Railways.

NOTABLE TELEPHONE DEVELOPMENT

A war-time invention in connection with telephony of which very little has been heard hitherto has very considerable possibilities in everyday use. The development in question arose on account of the difficulties experienced in communication on aeroplanes between the pilot and observers in the early days of the war and the task of devising a telephonic apparatus which would enable good articulation between a pilot and his observer under the conditions of noise which obtain on an aeroplane. It was taken in hand by Captain Cohen, of the Post Office Telephone Department, who was lent to the Air Ministry for the purpose. The main difficulty of course was to overcome the difficulty introduced by the noise of the engine and the other extraneous noises due to the speed of the machine through the air, and the problem resolved itself into evolving a suitable transmitter for the purpose, as obviously an ordinary mouth transmitter was out of the question. Eventually a throat transmitter was devised, which eliminated entirely the mouth transmitter and gave articulation which is as good as, if not better than, ordinary commercial speech over the telephone when using the standard mouth transmitter. The best position for this throat transmitter is in the hollows on either side of the windpipe, and by speaking in a normal tone in the midst of such noises as those produced by the exhaust of an aeroplane engine the speech obtained is quite clear and distinct. We understand that in addition to its successful use on aeroplanes during the war, this transmitter has been tested against very much greater noises, such, for instance, as that produced by four large aeroplane engines at full speed. There is little doubt as to the efficient character of the device, and we foresee two useful applications for it in ordinary commercial use. One is in noisy engine-rooms and machine shops and similar places which abound in industrial life, whilst an even more important use for it, perhaps, from the hygienic point of view, is on public telephones. The condition of the average public telephone is usually such that it can only be regarded as a virulent type of disease spreader, and the replacement of the mouthpiece, with its objectionable condensation, by a transmitter which is placed against the throat is a development which appeals to all on sanitary grounds. The moving system of this new throat transmitter consists of a metal diaphragm with an attached mushroom of insulating material and a carbon chamber with a mica diaphragm. We understand that the company which is making this apparatus has already had several applications for the instrument from industries in which noise is a necessary corollary, but so far the transmitter has not been made on a large scale, and for that reason the present cost is somewhat higher than the usual mouth transmitter apparatus; but when commercial manufacture is commenced a material reduction in cost is looked for.—"Practical Engineer."

CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Vol. XIII, No. 18. April 29, 1920

Are You Acquainted With Art of Roll Turning?

The Average Person Holds a Very Hazy Idea as to What is Meant by Roll Turning—The Art is a Very Important One, So We Give a Detailed Description Herein

By W. S. Standiford

AMONG all the various trades in the world, that of roll turning occupies a position which is important and unique. It is an occupation that is little known except by those who work in rolling mills, and the average person generally has a very hazy idea of the trade. I once asked a man: "What is a roll turner?" The answer I received was: "A roll turner is a baker." This man evidently had bakers' rolls on the brain. Some other people think that a roll turner is a machinist; this is also a wide mistake, as the trades are separate and distinct, the lathe and tools used in the one working in an entirely different manner from that characteristic of the other. As a general rule, machinists know nothing about roll turning; of course there are some who have taken advantage of an opportunity and learned the trade, but there are very few of them, as the rank and file of journeymen are recruited from apprentices who have served their four years' time at turning rolls.

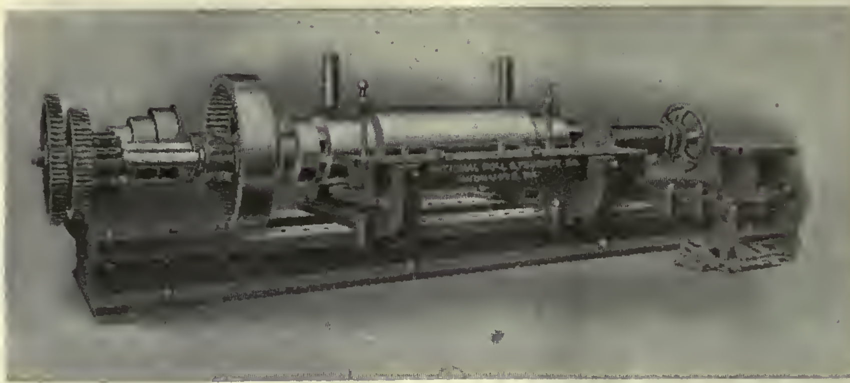
The influence that this trade has on the progress and civilization of the world is most remarkable as well as beneficial. Before the era of rolling iron and steel beams, rails, etc., came into use, the usual method was to forge or cast them. This was a slow and uncertain way, and produced articles far inferior in strength and appearance to the rolled ones; the output also was limited. The reason why the cast is inferior to the rolled section is that rolling gives a fibrous and more homogeneous structure which resists strains better. The rapidity with which various shapes and sections of steel can be rolled as well as the excellent quality and cheapness per ton secured has given to the world an engineering material that is unsurpassed for building bridges, steamships and machinery and the cheapness of its production is due largely to the improvements in roll-turning and rolling. Much of the comfort and safety in travelling and many of the luxuries we enjoy nowadays are due to the roll-turner's art, and it is the foundation of the iron, steel, copper, brass, and aluminum industries.

Roll turning was invented in 1785, by Henry Cort, an Englishman, and ever since then the trade has been developed by various roll turners and mechanical engineers, each one having added his "mite," until we have in our modern reversing and continuous mills machinery that is capable of turning out an enormous tonnage of iron and steel with very few men employed to handle the mills; this produces large profits with small expenses, and also a first-class product. The majority of rolling mills in the United States, however, are small ones, capable of turning out an output of 15 tons per turn and upwards. They are

A LARGE SIZE ROLL TURNING LATHE AT WORK.

gradually giving place to modern equipment, and there is no doubt but that in the future the small industrial plants will be equipped with up-to-date machinery. The rivalry for commercial supremacy will finally bring about this result. It is a case of the "survival of the fittest."

While the science of roll turning has advanced very rapidly, yet curiously enough there have been very few improvements in the lathe by which the roll turner produces such excellent results. Such as have been made relate to minor details, such as adjustments to permit the topping of rolls quickly, the fastening of the tool rest, the tailstock, the shape of housings, and also the application of electric motors mounted on the lathe for direct drive. Some of the modern direct-driven lathes are splendid examples of the machine-tool builders' art, the machines having gears running in an oil bath, the machines being stopped and started by means of push buttons. These lathes are about as nearly noiseless as can be achieved. Some have a controller like the ones that are on street cars, it being possible to reverse the machine at will when it is desired. This feature comes in handy when the tool prop bends and allows the tool to jam, it being very easy to withdraw the tool by reversal. But outside of all of the modern improvements, the fundamental principle of working remains the same, and always will despite the march of progress in other directions.



THIS VIEW ILLUSTRATES A WELL-KNOWN TYPE OF ROLL TURNING LATHE.

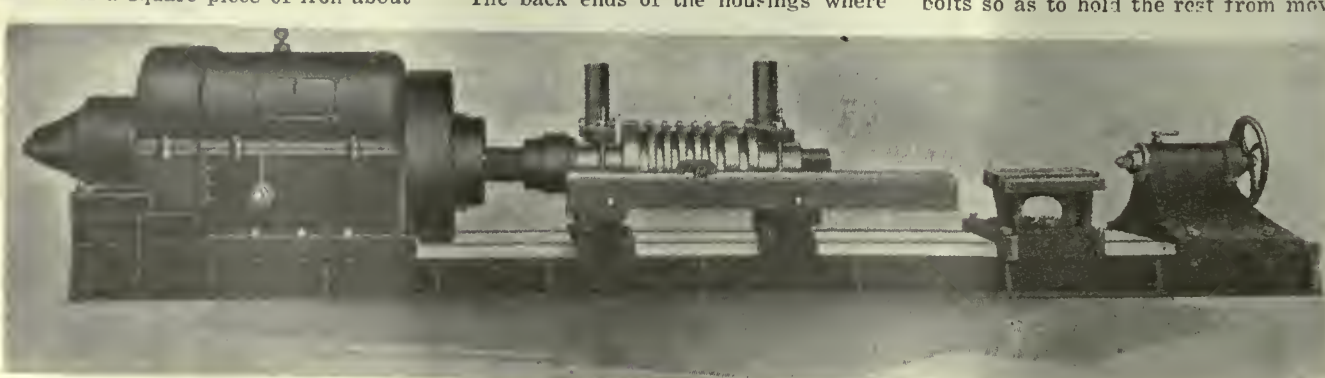
The Roll Lathe

The roll lathe is a device of extreme simplicity, and the turning tools are of such a character, and the methods of working them are such as are found in no other lathe. The machine is built in various sizes to take in different classes of work. It consists of a long and wide bed, hollow in the middle to hold the turnings, technically called "swarth." The necessary gearing and pulleys to drive the machine are located at one end of the bed. Revolving on a hollow shaft connected with the various gears and placed at a right angle to the bed, is a heavy wheel having the driving teeth inside in some lathes, and in others, the teeth are on the outside. The total diameter of the wheel is four feet or more in diameter. This wheel is called the "face-plate," and it has bolted onto the side, in the middle, a square-shaped box with fluted insides. Placed partly inside the fluted box and projecting outside of it is a square piece of iron about 18 inches long, with fluted sides; this is called a "spindle." Over this spindle is put a round iron box, the length depending upon the size of the lathe and the diameter of the rolls that the lathe is made to take. In this case it will be 8 inches long and is fluted inside; this is made of sufficient diameter so as to slide freely on the spindle. This arrangement is used to drive the roll when it is in the lathe.

All rolls are made with a journal or "neck," as it is technically called—on each end and also fluted wobblers on the extreme ends of the roll. The wobblers are of such a size that the round box on the end of the spindle is placed half-way on the latter and half-way on the roll. This makes a very flexible driver. Across the bed of the lathe and at a right angle to the bed, are two cast iron devices called "housings." There are square depressions in the middle of each housing, each containing an iron block with the upper end hollowed out and lined with babbitt. These form the bearings for the neck of the roll to revolve in. The bearings are arranged so as to have some end play; this being secured by set screws on the housing. bearings. The top bearings or "caps" are formed of long rectangular pieces of cast iron having a circular depression in the middle; each cap contains a round hole of sufficient size so as to slide freely over the back ends of the housings and down it. The front ends of the caps usually have inverted U-shaped slots. Through these extend long iron rods each threaded on the upper end and carrying a nut and washer; the lower ends of the rods are slotted and held in place by keys.

The back ends of the housings where the caps go over it contain a rectangular slot, and also a removable key which, with the aid of the threaded front rods with their washers and nuts, keep the top bearings or caps pressing down on the roll. The latter is put into the lathe, and so adjusted that there is ¼-inch clearance between the driving spindle and the wobbler on the roll; the spindle being turned around until the flutes in it are opposite the flutes of the roll wobbler. The box is then pushed half-way onto the wobbler. The caps are next placed upon the necks of the roll, the keys put in the back ends and the nuts on the front rods tightened. The set screws that operate the bottom bearings are then screwed up to prevent end play of the roll; the back bearings are also screwed up and pressed against the necks of the roll by the screws in the back of the housings. In adjusting the pressure of the various bearings upon the roll necks, it is important not to get them too tight as the roll, when it is revolving, will operate with a jerky motion and thus make chatter marks upon the work, which latter in turn will mark the bars. Too tight bearing pressure will also scrape the lubricant off the necks and cause cutting.

Across the front ends of the housings is placed a long rectangular casting containing two inverted T-shaped slots, one at the front end and the other at the back. This is used to hold the tool and is called the "rest." It also has numerous square holes extending from top to bottom. The rest is held from sliding endwise by bolts extending through the T-shaped slots in the bottom of it and the slots in the housings. The front ends of the housings also contain bolts so as to hold the rest from moving



ANOTHER STYLE OF GEARED HEAD ROLL TURNING LATHE.

backward when the tool is cutting, a lock nut on each bolt being provided to keep the bolts tight. In the slot running parallel to the roll, and next to it, is placed the tool carriage, a rectangular casting or forging with flanges on the bottom of sufficient size so as to allow it to slide freely in the T-slot. On the front slot of the rest is located the pusher, which is a solid piece of iron with a flange on the bottom working in a T-slot in the front of the rest. This pusher contains a long screw with one end tapered to fit a wrench; this is used to feed the tool into the roll.

Roll Versus Ordinary Lathe

There is considerable difference between roll lathe and machinists' tools, their shape and methods of working being entirely different. In order to show this clearly, we will suppose that a groove is to be turned in a roll for making bar iron. The tool consists of a piece of hardened steel 1¼ inches thick and 12 inches long, the width depending upon the size of the groove wanted; in this case, it will be four inches wide. The front edge is ground to a straight-edge; the right and left sides of the tool are ground a few degrees off a right angle, so as to leave the groove with a slight taper for clearance. The bottom edges of both sides and the front of tool also are tapered, so as to clear the roll, leaving the top edges to do the cutting. It is then placed in the tool carriage, and a small flat piece of iron called "packing" put on it and an iron wedge driven in to hold it in position. A post containing a set-screw is then inserted into one of the square holes in the rest opposite the front of the tool, another post being located on the other side near the rear end.

The pusher is then put in position back of the tool; lathe started up and the wrench on the pusher given a sufficient number of turns until the tool begins to cut, and given a turn once in every revolution of the roll. Should the latter be calipered at this juncture, it will usually be found that the cut is not going down straight, one part of the roll being cut deeper than the other. This is remedied by giving the shank a light blow with a hammer or else pressing the shank over by tightening the set screws in the side posts. In managing the tool and handling the calipers there is a considerable difference between the roll turner and the machinist. The latter, in beginning new work, sets his calipers a little larger than the finished size that is wanted, and feeds the tool attached to the slide rest into the work by hand, calipering with a set-spring calipers until he has the desired size. Then he connects the slide rest with the lead-screw and the tool is then dragged sideways along the work, cutting upon the side and point. The V's on the lathe ensure that the work is turned straight. Work on a machinists' lathe is always slightly out of true circular form, no matter how fine the feed is. This is due to the cut being dragged sideways before it runs out. The machinist when sizing work with his calipers generally has a heavier touch than the roll turner. The latter handles his calipers so as to just feel the roll; this is called a "feather-touch," and it is essential to good roll turning. The roll turner does not set his calipers to the desired size, he being obliged to follow the cut down by knocking the calipers gently until it touches the roll lightly; he then tries the feel of it on the part of the roll opposite to the one touched. This shows him whether the tool is cutting straight or otherwise. In order to keep the cut going straight, the groove requires to be calipered often, as the roll turning tool shifts slightly which is due to the wedge and the pusher action; the latter moving off the centre of the tool and the former loosening slightly as the tool is fed into the work. When the groove is within 1-32 of an inch of the finished size wanted, the workman takes out the roughing tool and puts in the finishing one, which is very sharp; he takes a light cut and allows it to run out when the groove will be found to be accurately round.

In turning the necks or journals for rolls, the housing, rest and driving box and spindle are removed from the lathe. A centre is put in the hole in the face plate; the tail-stock containing its centre is put in place on the bed of lathe and bolted down. The roll is centered and the holes bored in both wobbler ends to match the angle of the centres. A driving dog is slipped over the end of the wobbler next to face-plate, its bent ends pressing against lugs cast in relief upon the face-plate. This drives the roll when it is on the centres. The tool rest for necking is a casting about two feet wide, having the usual slots and holes on its top as previously described. The rest is of sufficient length to go across the bed of lathe, the height being such as to allow the tool to be one inch below the centre of roll, which gives the cutting power to it. A machinists' lathe tool can cut on the centre, and above or below it. Roll turners' tools will not cut on a centre line of the roll, nor above it, but always have to be placed below the centre. Machinist lathe tools operate with a true cutting action as contrasted with roll lathe tools, the latter cutting with more of a scraping action, hence the necessity to use them below the centre line. The power required to run roll lathes varies with the weight of the roll, the width and angle of tool used and the material turned such as cast iron, semi-steel, steel and chilled iron rolls, also speed of lathe and thickness metal removed. Using a 3½ inch wide tool and taking as heavy a roughing cut with ordinary high-carbon tool steel as the metal will stand, it was found that 7½ h.p. was required. Taking a finishing cut with the same-sized tool 3¼ h.p. was needed. These results were taken from actual tests made by the writer and were given by means of electrical measurements, the lathe being driven by an electric motor of 15 h.p. The roll diameter being 26 inches, a cast steel roll being used for the test.

Heavier cuts can be taken on cast iron (called sand rolls) than on steel rolls. This is due partly to the tougher and harder nature of the steel which in the thick diameters is not as well annealed as it might be. Steel also exerts a "drawing-in" action on the tool, the latter being dragged into the roll metal while the turning is being done. When a heavy cut is taken, the roll continues to draw the tool in until the latter has over-reached its cutting capacity; then the weight of the roll comes on the tool, bending the prop under it and breaking the tool. For this reason it is not advisable to take too heavy cuts in turning steel rolls. It must be understood that the above-mentioned width is not the widest tool that can be used on roll lathes, various sizes being used. The width of the tool also depends on the method of driving the lathe—whether belt or direct driven. Some belt-driven lathes having all they can do to pull a cut 6 inches wide, steel for roll turning tools should be very high in carbon, 1.50 per cent. making fine tools. This, however, must be heated very carefully by the blacksmith so as to avoid burning; a cherry-red is the highest that it will stand. When rightly heated and hardened it gives fine service, and takes a good sharp edge. High-speed steel is not used for turning rolls to any extent on account of its price, as roll turning tools require more metal in them, which makes them more expensive than the ones used on machinists' lathes. But it would seem that there is a brilliant future for using high-speed steel for roughing down work on all metals except chilled cast iron, providing that a satisfactory method of welding the metal to a bar of ordinary steel can be found, as only a small piece of the high-priced material would have to be used.

The writer had a test on roughing down work using high-speed metal for turning a steel roll, the tool being a solid bar of the steel ground to shape and hardened in an air-blast. Using the fastest speed on a modern roll lathe, it was found possible to take a far heavier cut than the best ordinary metal would stand; the chip being the color of a blued watch spring. The test also showed that the roll lathe pusher screw should have a coarser thread, as it required a large amount of quickness and brute force to sustain such heavy cuts. High-speed steel was tried out on a chilled cast iron roll, but the edge lasted for only one revolution of the roll. Re-hardening did not make any difference in the results, it being concluded that this metal is unsuitable for turning chilled rolls. However, for ordinary work, the writer likes high speed steel, both for roughing and finishing work, there not being so much grinding tools for roughing down as the ordinary variety needs.

STRENGTH OF PLATES AND RIVETS

(Concluded from Page 415)

The diameter of bar which will have the same area as the net area of the plate.

The thickness required in a plate having more holes than another, but to have the same net area.

The load which any of the above will carry at either of the two stresses.

Chart for Net Strength of Plates and Rivets

Designers Working Out Connections for Tension and Compression Members Which Have to be Connected With Gusset Plates, etc., Will Find This Chart Very Useful in Making Their Calculations

By John S. Watts

THE accompanying chart will be found useful in working out the connections for tension and compression members which have to be connected by gusset plates, and for such cases as brake straps to which have to be riveted the forged end connections, or, in fact, any case where we have to make a riveted connection to carry a given load.

In the solution of the above problems, the width and thickness of plate required is dependent upon the number and size of rivets adopted, and the problem cannot be solved directly, but generally involves a series of calculations on the cut-and-dry method, which is a tedious and time-consuming one.

By using the chart, we can see at once all the possible combinations, and quickly choose the most convenient one.

To use the chart, simply follow along the horizontal line for the load required at the allowed stress. For a dead load, the stress may be taken as 16,000 pounds per square inch, and 12,000 pounds for a live or intermittent load. The foregoing are the tensile tresses on the plates, for the rivets take 12,000 and 9,000 pounds per square inch, respectively.

The width of plate required for each thickness, to carry the load, can then be scaled off at the bottom of the chart by dropping a vertical line from the intersection of the diagonal line for the thickness and the horizontal load line to that line marked for the diameter of rivet called for by the chart.

The total width of plate required is that length from this vertical line to the intersection of the lines for the number and diameter of rivets (that is, the number of rivets in the first line of rivets) called for, scaled from the chart with a half-size scale.

For example, we will take the design of a brake strap and forged end connection to take a pull of 20,000 pounds at a stress of 12,000 pounds per square inch, the general design being as shown in Fig. 2.

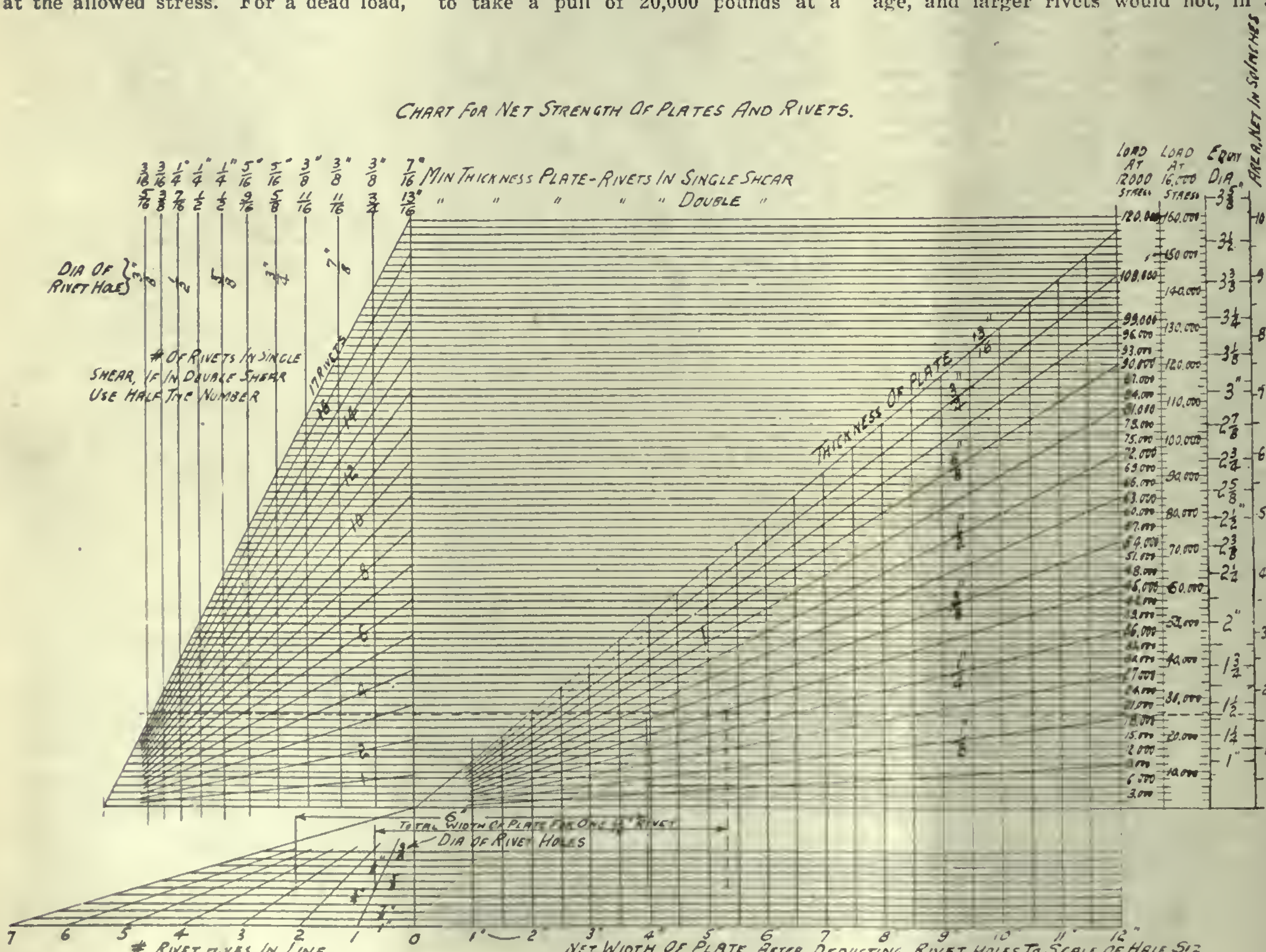
In this case the width of the plate is already decided by the width of the brake surface required, and we will assume this to be six inches.

Now drawing the horizontal line at the height representing 20,000 pounds on the 12,000 pound stress scale, shown by the dotted line in the chart, we see at once that 5-16 inch is the thinnest plate that will give the required strength.

For flexibility the brake band should be made as thin as possible.

The plate, then, being 5-16 inch thick, the chart shows that the largest rivet we can use in single shear will be 11-16 inch diameter of hole, and that six of these rivets will be required.

The chart gives us the choice of other sizes of rivets, but to use smaller rivets and more of them would be of no advantage, and larger rivets would not, in a



A STUDY OF THE CHART IS ESSENTIAL IF YOU DESIRE TO OBTAIN THE BEST RESULTS FROM THE READING OF THE ARTICLE.

5-16 inch plate, develop in compression their full shearing strength.

Checking back, by measuring the width of the plate, six inches from the intersection of the 11-16 inch rivet line and the diagonal for one rivet, we find that the six-inch width is slightly more than is required, but that two rivets in the first row would reduce the strength too much. We, therefore, space the rivets, as shown in Fig. 2, with one rivet only the first row, two in the second, and three in the third.

At the end of the strap, then, we have a line which has three rivets on it, and, as this line is the one on which the forged end would tear apart, the forging must be increased in thickness here to give the same net area as that of the plate after deducting the rivet holes.

The required thickness is found on the chart by measuring back six inches from the intersection of the 11-16 inch rivet line and the diagonal line for three rivets and raising a vertical at this point, when we find that the required thickness is 7-16 inch.

At the extreme right-hand side of the chart, we find the diameter of the forged end will require to be 1½ inch, to have the same area as the plate has after deducting the rivet hole.

If it should be desirable to use some other stress than the 12,000 or 16,000 pounds used in the chart, it can be accomplished by taking for the load

$$\frac{\text{the actual load} \times 16,000}{\text{stress.}}$$

A description of the method of laying out this chart will make the user more familiar with its use and convenience, and is as follows:

First, we lay off the horizontal line for the base of the two triangles, the triangle to the right having a base line twelve inches long drawn to half size.

The vertical line for this triangle is made 13-16 inch high, to a scale of 3-8 inch = 1-16 inch, division being marked to indicate each 1-16 inch thickness of plate to the same scale, and drawing diagonal lines from each point to the end of the base line, as shown.

On the base line, points are marked representing the widths of the plate in half-inches up to twelve inches, and vertical lines drawn at each point.

It is obvious now that the height to the intersection of any thickness line, with any width line, will be proportional to the area of a plate of that width and thickness (without rivet holes), and hence, proportional to the load it will carry with any given stress.

This being the case, we can calculate the safe load on the maximum size of plate, viz., 12 inches by 13-16 inch, and divide up the vertical line to show that load at 12,000 and at 16,000 pounds stress.

Coming now to the triangle at the right, we calculate the load that can b carried by from one, to seventeen, one inch rivets at 9,000 pounds stress in single shear. Marking these points on

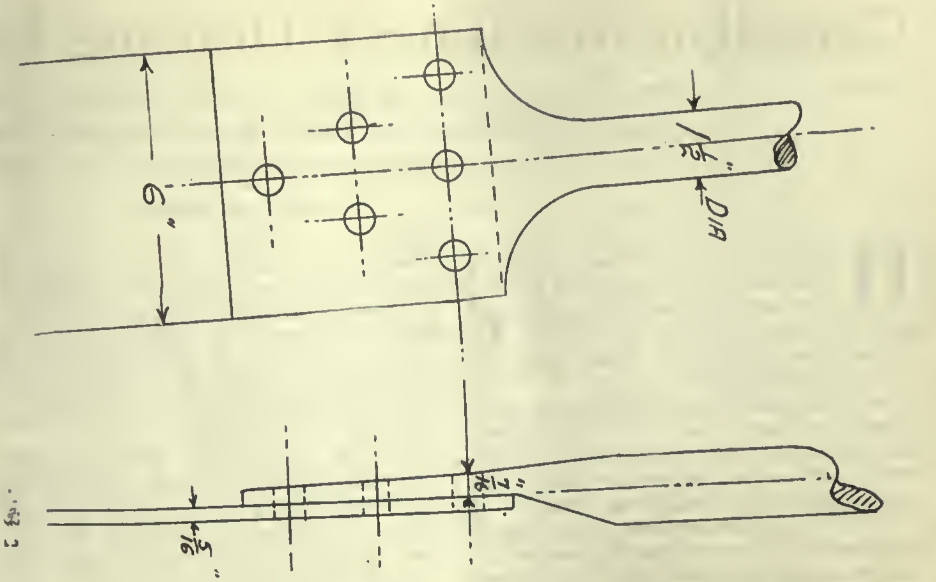


FIGURE. 2.

the vertical line of the left-hand triangle, as shown, using the scale for the 12,000 pounds stress on the plate, which is the stress used, when using 9,000 pounds stress on the rivets.

This means that the rivets will, in all cases, according to the chart, be stressed at 75 per cent. of the stress in the plate; or, if the stress in the plate is taken at 16,000 pounds, the stress in the rivets at 75 per cent. of the stress in the plate; is stressed 12,000 pounds, the rivets will be stressed to 9,000 pounds in shear.

The base of this triangle is made to scale, the lengths marked being equal to the squares of the diameters of the rivets, to any convenient scale. This, because the strength of the rivets in shear varies as the square of the diameters. This is accomplished in the chart by taking the diameters of the rivets in eighths, i.e., the one inch rivet is 8⅛ inches, and $8^2=64$; therefore, the length of the base is 64 units long, to a scale of ⅜ inch=12 units in the chart, and the other points are marked in the same way.

Now we join the seventeen points on the vertical line to the end of the base line, and erect vertical lines on each point marked for the diameter of a rivet. The height to the intersection of any diameter line and any "number of rivet" lines will clearly be proportional to the load that can be carried by that number and diameter of rivets, and will be the load found marked at the right under the stresses 12,000 and 16,000, but the stresses on the rivets will be respectively 9,000 and 12,000.

As already shown, we have at the base of the right hand triangle, the net width of the plates, to which must be added the width taken up by the rivet holes, to get the total required width of plate.

To accomplish this, the lower left-hand triangle has been added, the vertical of which triangle is made one inch high, for the diameter of the largest rivet, and divided up into sixteenths to denote the smaller diameters.

The base is made 7 inches long, to the same scale as the base of the right-hand triangle, namely, half-size, and diagonal lines drawn to each one inch division. It follows, then, that the length of any horizontal line to its intersection with any diagonal "number of rivets" line, is equal to the diameter of the rivet multiplied by the number of rivets represented by the lines intersecting at that point. Or, in other words, is the width to be added to the net width of the plate to cover the amount cut away by the rivet holes.

We can, therefore, scale off the total length of any plate, by measuring the length from the net length required, as given by the vertical from the load and thickness intersection to the point where the lines representing the number of rivets and diameter of rivets intersect.

At the top of the diameter of rivets lines, note has been made of the least thickness of plate, which will develop in compression, at a stress of fifty per cent. more than the tensile stress, the full strength of the respective diameters of rivets in single and in double shear.

As the chart is made up for rivets in single shear, only half the number of rivets called for by the chart will be necessary, if the rivets are in double shear.

To summarize, the chart will show, given a certain load,

The number and diameter of rivets required at either 9,000 or 12,000 pounds stress, in single or double shear.

The minimum thickness of plate at which these rivets will carry the load at either 18,000 or 24,000 pounds bearing stress.

The width and thickness of plate required to carry the load with one to seven rivet holes from ⅜ inch to one inch diameter, at a stress of 12,000 or 16,000 pounds.

The net area of the plate after deducting the rivet holes.

Continued on page 413

Canadian Machinery Drafting Course—Part XIII

We Next Go Into the Design of the Swivel Base—Students Are Given Two Views, the Third to be Completed From the Information Given on Plate and Text Matter

—By J. H. Moore

HAVING completed the drawings for the vise—in as far as the actual working parts are concerned, we will next take up the problem of drawing the special swivel base as shown on the present plate.

For ordinary straight milling machine work this base would be unnecessary, but when one might desire to set the work at some particular angle, the swivel base would be very essential.

In order to make their vises useful for varied classes of work, manufacturers adopt different ways and means of designing them. Some are equipped with a tilting arrangement in addition to the horizontal swivel movement, but this type of vise is seldom used for milling machine work, but more generally on drill presses. As a rule, a vise similar to what has been already drawn by the student, is the type adopted for milling machines.

The practice which the student has already experienced on the previous plates should stand him in good stead in the present instance. We would strongly advise that frequent reference be made to the previous plate when preparing this one in order that every student be absolutely sure why he is drawing the base as it is shown.

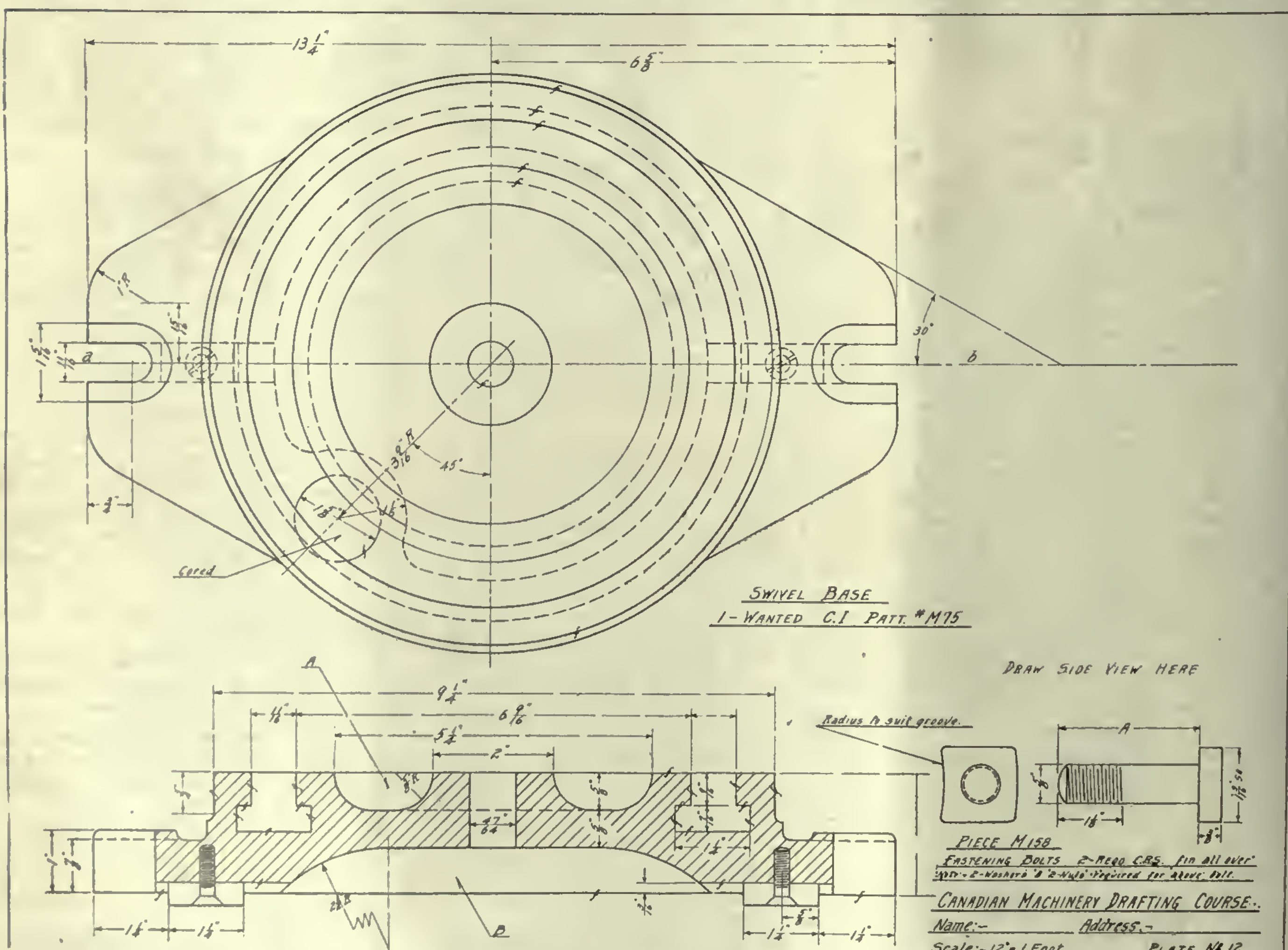
Straight copy work is not time study. The basic principle must be kept in mind and before a line is drawn the student should spend at least ten minutes discussing in his mind the whys and wherefores of the plate.

In preparing the plate, it would be well to keep in mind the fact that in actual designing it is not always possible to complete one view without partially completing another view. In other words, in actual designing, it is often found necessary to partially draw (say, a side view) in order to project up certain opertions of this view to the plan.

Another point to be borne in mind is that a safe place to start from is the centre lines. For example, let us consider the present plate. An ideal spot to commence work on this plate is at the centre line intersections of the plan view. From this point one can work along without any difficulty. For the purpose of ascertaining how students are progressing in what might be termed good judgment in arranging of views, we will state no particular size for this plate. The only stipulation that we make is that all the views must be drawn full size.

No doubt student can readily grasp the use of this base, and can understand why the circular Tee slot is necessary and so on. Briefly, the base rests on the miller table, and is kept in line longitudinally by the ⅝ inch wide tongues on the bottom. These tongues go into the Tee slots on the miller table. This naturally lines the base up.

Directly on top of the 9¼ inch diameter portion sets the regular vise. On



REMEMBER THAT THE BEST WAY IS TO START ON THE PLATE AS SOON AS YOU RECEIVE THE COPY.

referring back to the previous plate it will be noticed that the straight base of vise had two lugs cast on it which were 4⅝ inch radius from the centre, or in order words, an equivalent to 9¼ inch diameter. This means that the 9¼ inch portion on the straight base matches up with the 9¼ inch portion on the swivel base.

The holding down bolt shown at Fig. 2 (and of which there are two), goes into the circular Tee slot in the swivel base, projecting up through the base, and into the two slots shown on the straight base. The idea is self-apparent, for by slackening off the two bolts, the vise can be swiveled to any desired angle, then immediately locked in that position. To get these bolts into the Tee slot looks perhaps to the tyro a ticklish proposition, but the solution is easy to the initiated. A 1⅝ inch hole is drilled up from the bottom of the base, and a wall of metal, as shown by the dimension 1⅛ inch radius run around this hole. The bolts are so made that their extreme measurement from corner to corner of head is less than 1⅝ inch, which allows the bolts to pass through this hole up into the Tee slot. Once in place the rest is easy.

It will be noticed that the bolt heads are made with a radius similar to the radius of the Tee slot. This, of course, is absolutely necessary when one considers that the bolts must travel around in the circular Tee slot. The depression marked A is merely a method adopted of relieving the metal in order that unnecessary machine work be eliminated. When a machined face is of undue and unnecessary width, there is a great chance for the surface not being absolutely straight. which would, of course, show up on the portion resting on it. The outcome would be a rocking motion between the surfaces, causing inaccuracies, which later would mean spoiled work.

This is a point often forgotten by many designers, so that we mention this as a hint and as a good-natured warning to those already following the drafting profession. Always be sure to give enough bearing surface BUT give only enough. Any more than enough is needless machine work and a chance for error.

The same principle holds good for the depression B. Not only is this relief made to eliminate unnecessary machining, but it is so designed to reduce the weight of the vise as well. Depressions in this way accomplish a double purpose, and as students proceed further on in the course they will realize more and more their value.

Having pointed out these few items, let us proceed with the drawing of the plate.

Starting at the plan view, first draw your two centre lines. Having done so, proceed to describe your circles. It is optional which you draw first, but this is the method the writer would adopt personally. He would first describe the 9½ inch circle, which is the extreme width of the base. Next would come the 9¼ inch circle representing the diameter at the top finished portion. Now would come the 6 9-16 inch circle to the inside upper edge of the Tee slots, after which he would draw another circle 1⅜ inch diameter larger. This circle would, of course, represent the outside upper edge of the Tee slots, as twice 11-16 inch widths equals 1⅜ inch.

Next in order would come the 5¼ inch circle which is plainly visible to the eye on the plan view.

The next step would be to draw the dotted or hidden circles. As the Tee slot is 1¼ inch wide at the bottom, this means that it is ⅝ inch from the centre of the T slot to either edge of the bottom of slot. Figuring from this, we have the following: 6 9-16 inch, the dimension to the inside upper edge of slot, plus 11-16 inch, which means the width of the slot, we have 7¼ inch centre to centre distance to the Tee slot. Deducting 1¼ inch from this, we have 6 inch diameter for the inside lower edge, and adding 1 inch we have 8½ inch to the outside lower edge. This means that the one circle has to be 6 inch and the other 8½ inch.

Having completed these circles, we next draw the relief depression B. As this is plainly marked 7 inch, proceed to draw this circle, but watch out for the point when the 1⅝ inch hole is marked. This hole comes at 45 degrees from the centre lines as shown, and is 3 9-16 inch from the centre point. Draw the hole in place, describe also the 1⅛ inch radius, and join this radius to the 7 inch circle by small ½ inch radii.

Next let us draw a faint line 6⅝ inch on each side of the vertical centre line. Coming in ¾ inch on the horizontal centre line from these points, we can next draw the 11-32 inch radius, and 21-32 inch radius, joining these by straight lines as shown on plate. This represents the shape of slot and outline of boss for the table holding down bolts.

Going up and down 15-16 inch from the horizontal centre line we next proceed to describe the 1 inch radii shown, joining these curves to the 9½ inch diameter portion by straight lines. This completes the outline of the base. The next and last step is simple. 5-16 inch from each side of horizontal centre line describe line to represent the hidden slot at bottom of base.

Draw a vertical line 1¼ inch in from each end, also one 2½ inch in from each end, these two lines representing the outline of the two tongues. Central with these two outlines describe the outlines of the flat head screws, and in case students are not familiar with the dimensions of a 5-16 inch flat head screw, the following sizes are the usual standard adopted. Diameter of bolt, 5-16 inch; diameter of head, ?; the length of head, ? This completes the plan view, so next we will proceed to the side view, which for clearness is given in section form.

In commencing this view the value of projection must first be remembered. Proceed to draw down from all points thin faint lines. Before drawing these lines a good plan is to determine the actual location of your view, that is what space you propose leaving between your views.

For example, suppose we decide to leave 1¾ inch between the top line of side view and the edge of the 9½ inch circle on plan. Having decided this point we draw a line as long as we think necessary, then measure down from this line the complete depth of the base, in this case, 2 inch. We now draw this line in similar manner. Having done so we have actually decided the limit points of the projection lines, and saved ourselves a good amount of unnecessary erasing at the finishing up of our plate.

After projecting down the various vertical lines, we proceed to measure the sizes shown on the side view, drawing in the various points.

For example, suppose we again start from the centre line and work out. Having projected the 2 inch and the 5¼ inch dimensions down, let us join these points with a ⅝ inch radius. As our centre point for this radius is shown to be on the upper line of the base, this means that the depression is ⅝ inch deep. Next, we can construct the Tee slots. Measuring down 9-16 inch and 7-16 inch, we soon complete these points.

We can now proceed to come down ¾ inch on the 9¼ inch portion, and at this point describe a ⅛ inch radius to meet with the 9½ inch portion. This point showns where the machined portion of the base ends. The laying out of the feet of the base could come next, and this is so simple that no comment is necessary.

We can next draw the lower depression B. The diameter inch is, of course, projected from the plain view. We might say at this point that some students will be apt to say: "Oh, hang the projection! We can measure it 3½ inch on each side of the centre line," but this is not the correct method. Learn to use your knowledge of projection for you will require it later on. Always remember the fact that in designing, a good knowledge of projection is absolutely essential.

Referring once more to the depression B we see that this portion is ¾ inch deep, but that a 2½ inch radius is described to join the horizontal line. Students can readily accomplish this without trouble. Lastly, draw in the tongues, their screws, and the outline of the tongue slot.

This completes the view, with the exception of the section lining, and as the material is grey iron, the lines are single, and about spaced as shown. Some drawing offices order their section lining closer, but we do not wish to give students undue work, and the style shown on plate will be o.k. Remember, of course, that the plate illustrated is much reduced in size, so allow for this fact. About ⅛ inch between lines will be splendid in every way.

The Principle of Sectioning

In order that students thoroughly

grasp the idea, and fundamental principles involved in the art of sectioning, we will devote a short time to the discussion of this subject.

There is no hard and fast rule regarding sectioning. From this we do not mean to infer that no standard practice is followed out. A standard style of sectioning IS followed out, but should one wish to deviate from one section line and jut over to another, this is permissible.

The section shown is one taken through a straight line, in this case the centre line, but this is done simply because it so suits our purpose. For example, suppose this base had been more intricate in character, and that we had desired to show up certain portions of it in section.

Some of these portions happened to be on the centre line, while others were not. What could we have done? We could easily follow out two plans. Either make two sections or a partial section on the centre line as far as we desired, then jut up to the other desired point and proceed as usual. To illustrate where we had taken the section, we would have drawn a line showing the path taken by the section, which brings us to the point of "What is a Section?"

About as simple an explanation that the writer has ever heard is as follows: Suppose the object (no matter what it be) is made of wood. Let us further suppose we desire to see what this object looks like in section along a certain line. Let us mark on the object the line through which we desire a section.

Now let us suppose that we take a saw and cut through the object along this line. Having cut through, let us take up the object and examine it. Where the saw has cut through the material you will see saw marks, and where no material exists (such as holes) you will see no saw marks. Section line the parts touched with the saw and you have your section. This principle we believe is so simple that every student will grasp the idea. Let us consider the section shown on the present plate and imagine that we started to saw through the plan view along the line a—b.

First, our saw didn't touch any metal till it reached the end of the holding-down slot. Now we proceeded to not only saw a portion of the base but also into the tongue at the bottom, also right through the flat head screw. Shortly after this point our saw entered the T-slot and of course had no metal to come in contact with. Next we struck another part of metal and suddenly we entered both the top and bottom depression. The only metal encountered with at this point was the centre web, which gradually thickened around the centre boss. The other side of the centre line was of course a reversal of the side already described. Believing this thoroughly describes the principle of sectioning we will pass on to the subject of the side view.

The Side View

This is the point where the student has a chance to shine and show his knowledge. Having given the plan and sectional views, we feel that the student with the practice so far received, is no doubt competent to draw this view unaided, so that we have left the view blank on our plate, merely stating: "Draw side view here.

Relative to this view we can only add, take lots of time, project your various points across, and study the various details before completing the view. This will be good practice for you, at the same time showing us how you are progressing. The fastening bolt drawing is so simple that no comment is necessary.

As final advice on this portion of our course we would like to emphasize the danger of copying our plates without first studying the principle involved. Do not be in a hurry for we will not judge any future plate until one month from date of issue.

This plate will not be judged until one month from present date. We do this in order to give everyone a chance to complete the plate. We have students in Vancouver, Chicago, St. Louis, New York, New Glasgow, in fact at all corners of the country. We want them all to have a chance, so go it every one of you and show us that you are following our instructions.

We call students' attention to the fact that the original plate shown in this lesson was drawn, not by the writer, but by another member of the staff. This was done to illustrate the different styles adopted by different draftsmen, and students will, upon investigation, find various differences regarding the placing and arranging of arrow-heads, etc. It will pay readers to compare the two styles, for, by so doing they will learn that individuality counts a great deal in the preparing of any drawing. Be natural above all else and do not try to copy anyone else's style.

ANGLE OF VEE

The generally accepted rule for bevelling the edges of pieces to be welded is to cut each side at an angle of 45 degrees, thus making the included angle of the groove about 90 degrees. It would be incorrect, however, to state that the angle should be invariably 90 degrees, without qualification. While it is true that the 90-degree angle gives the best average results, and the welder should always aim to maintain this angle at the point of fusion and welding, this does not necessarily mean that, when preparing a heavy broken casting the included angle should be 90 degrees from the bottom up. On the contrary, it would be a mistake to bevel the edges of a casting 4 ins. thick so as to produce a 90-degree groove throughout. It would mean waste of gas, adding material and time, and no better result than could be produced if the sides were cut at an angle of, say, 80 degrees, thus producing an included angle of 60 degrees. The bottom of the V can be maintained at the proper welding angle very readily and all the advantages of the 90-degree groove secured. A curved effect is even better, as the sides can then be made practically parallel at and near the top. So long as there is room in the groove for the welder to manipulate the torch and to see what he is doing, that is sufficient. The rule, then, should be to cut the bevel with the object of providing sufficient room for manipulating the torch, and no more. The rule providing a 90-degree angle for the groove applies correctly only in comparatively thin metal when the thickness is not sufficient to warrant any great amount of trouble being taken in bevelling the sides to save metal.

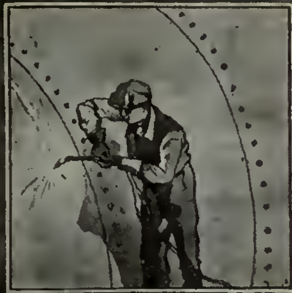
INTERESTING CATALOGUE

The Bellevue Industrial Furnace Co., Detroit, Mich., have, in their catalogue No. 4, a book that should be in the hands of all interested in the treating of steel.

Various style furnaces, ovens, blowers, testing kilns, tire heaters, pyrometers, etc., are fully described and illustrated. There are 88 pages to this book, and all cram full of information. A copy of this catalogue will be sent up on request.

The Albert Herbert, Ltd., Coventry, England, have placed on the Canadian market through their branch at 21 Yonge St., Toronto, their line of patented concentric chucks.

These are made in six sizes from 9 in. to 25 ins. diameter, and embody many features of interest. We intend showing this chuck in detail in a later issue.



WELDING AND CUTTING

Lessons on the A.B.C. of Good Welding

This is the Second Lesson by an Authority on the Subject—The Remainder of the Series Will Follow

By W. B. Perdue*

HAVING familiarized himself with the muscular training necessary to proper manipulation of the welding torch, the beginner is ready to learn how to properly adjust welding or neutral flame.

The muscular and other training exercises should be continued unceasingly, as only by patient and persistent practice can perfection be attained. These exercises will be explained in every detail to the degree that the only excuse for failure will be the lack of will to continue the practice; or, in rare cases, physical or mental deficiency.

It is absolutely essential that the welding flame be accurately adjusted and kept so. Not one welder in fifty knows how to do this. The pressure tables furnished by some makers of welding equipment are at best misleading. The only real welder is the one who can pick up a torch of a type that he has never seen or used and instantly adjust the flame in such manner that no excess pressure will be carried on the oxygen line, thus insuring the best results obtainable from the torch used.

Acetylene Needed

It should be emphasized that acetylene is the fuel gas, and that it requires a certain definite quantity of acetylene to produce a certain definite amount of heat. Proper regulation of the flame depends, therefore, upon first passing through the torch the correct volume of acetylene, and afterward adding to it an exactly equal volume of oxygen. Any attempt on the part of the operator to draw in an increased amount of acetylene by means of excessive oxygen pressures is tantamount to an admission on his part that he is unfamiliar with the principles of combustion. In such cases the temperature of the flame is actually lessened. The excess gases are in all such instances entrapped within the weld, which cannot be other than unsound.

Further consideration of the above facts, and further study of the principles of combustion, should convince the student that he must, without further delay, master the rules which govern the regulation of the welding flame; that any excess oxygen or acetylene passed through the flame is ruinous to good welding; that even the trained operator cannot make a sound weld with inferior apparatus which does not properly stir the gases together; and that, for his own protection, he must be able to make the tests necessary to determine the efficiency of his apparatus.

Process of Regulation

Having set up the welding station and noted that the valve on the torch marked "oxygen" is closed, the operator will open the torch needle valve marked "acetylene" one-half turn.

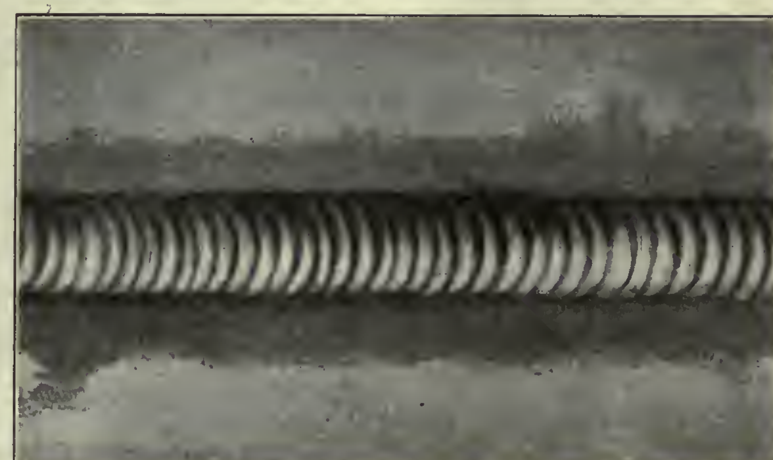
He will then turn the pressure regulating screw of the acetylene regulator to the right until the acetylene begins to flow through the torch. When sufficient gas has passed through to expel the air from the hose, the torch is lighted, after which the pressure is increased until the flame ceases to give off smoke.

This, of course, indicates perfect combustion. It is imperative that the volume of acetylene passing through the torch be sufficient to cause this perfect combustion, and that, having secured the proper volume of acetylene that it shall not be increased either by turning on a greater pressure at the regulator or by sucking in an increased amount by means of excessive oxygen pressures.

Relighting of Torch

Regulating the pressure in this manner enables the operator to extinguish and relight the torch and instantly secure the proper acetylene flow by opening the needle valve one-half turn.

With just enough acetylene flowing through the torch to prevent the flame from giving off smoke—no less, no more—the operator will open the torch needle valve marked "oxygen" two half turns (one full turn), or twice as wide as the acetylene needle valve.



A VIEW OF A RIPPLE WELD MADE BY A STUDENT.

He will then turn the pressure regulating screw of the oxygen regulator to the right until the yellowish flame (called the reducing or carbonizing flame) blends with, but is not entirely removed from the clear-cut white cone. To entirely remove all trace of this yellowish flame produces an oxidizing flame. To leave it too much in evidence produces a carbonizing flame.

It some times happens that the acetylene flame is blown out when the oxygen is turned on. Opening the acetylene needle valve to a certain predetermined point enables the operator to partially close this valve until sufficient oxygen has been turned on to heat the flame, then open it to the proper point, and af-

*Director Welding Department, Healds Engineering School, San Francisco, Cal., also manufacturer of Perfectype acetylene generators, torches, and regulators.

terward make the final adjustment of the flame with the oxygen needle valve.

With extremely large tips, it may be desirable to open the acetylene needle valve more than one-half turn. In such case the opening of the oxygen needle valve need not exceed one and one-half turns.

Proof of Regulation—Tests of Torches

To prove that this is the correct adjustment of the flame take a torch and, having adjusted it as above described, bring the outer end of the white cone down until it barely touches a piece of steel or iron, imparting to the torch the proper motion used in welding. The metal will melt and the surface will have a mirror-like clearness, but no reddish bubbles will appear beneath the surface, nor will the metal begin to froth or foam so long as proper motion is given the torch.

Then diminish the oxygen supply and reddish bubbles will appear just at the surface of the metal. This shows that the carbon from the flame is entering the melted mass. Carefully note this phenomena. In welding it indicates that the flame is carbonizing; that the tip in use is too small for the job, or that a larger area of metal in the vicinity of the weld must be brought to a cherry-red heat.

Readjust the flame and melt another spot, this time increasing the oxygen supply. This increased oxygen supply may or may not suck in an excess of acetylene and cause the flame to become carbonizing. At any rate it will cause the surface to become covered with froth or foam—the indication of the oxidation or burning of the metal. This phenomenon should be noted and carefully avoided while welding.

The burning of the metal produces heat, which, in turn, increases the fluidity of the metal in the vicinity of the weld. A weld—if such it may be called—can thus be executed with great rapidity and with a spectacular display of flying sparks. Many self-trained operators honestly imagine that this burning process actually makes a dependable weld. A few bending tensile or acid tests of their work will reveal to them the fallacy of their opinions.

Next take an inferior torch and make the same tests. Observe that the metal continues to absorb carbon long after every trace of the yellowish flame has been removed from the cone. Also observe that the metal froths and begins to burn long before the yellowish flame is shortened down and merged with the outline of the cone.

When using low-pressure injector type torches, which cannot be regulated by the methods just described, these tests are particularly valuable. With this equipment it is advisable to open the acetylene needle valve on the torch twice as wide as the oxygen valve and then secure the neutral flame by adjusting the pressure at the oxygen regulator.

Tests vs. Theories

These tests prove the theory advanced many years ago to the effect that "The freedom of a flame from being carbonizing and oxidizing is not necessarily indicated by the clear outline of the cone, which merely indicates that all the particles of oxygen and carbon that come together are burnt, but free particles of each may, with some torches, pass through the flame into the molten metal, which is thus injured and gas wasted, even though the theoretically correct proportions of the two gases are being supplied."

These tests also substantiate the theory that "Perfect combustion within the zone of the welding flame becomes possible only when the atoms of acetylene and oxygen are brought into intimate contact with each other. This in turn becomes possible only when the gases, in theoretically correct proportions, both under their own independent pressures, are driven and combined together; and, after being thoroughly stirred are brought without convulsive motion and without excess pressure through the orifice of the tip to produce the welding flame."

For practice secure a quantity of steel or iron in strips from 1-16 to ⅛ inch in thickness. Practice on this material should be continued until the operator is able to produce a fairly even "ripple" twenty-four inches long on the surface of the metal. The position of the body should be as erect as possible; the left hand should be encouraged to follow the motion of the right; and the right foot should be placed slightly in advance of the left.

Having mastered the "ripple" the operator should commence practice with the rod, assuming the position shown in Fig. 3. The rod is given the same oscillatory movement as is given the torch (Fig. 2).

It will be noted by reference to Figs. 2 and 3, the flame impinges upon the sloping portion of the built-up metal in the weld It is particularly important that the flame be kept in this position and that the sides of the weld shall be in thorough fusion prior to the addition of the welding rod. It is equally important that the work be finished while heated, as any attempt to go over and "smooth up" the work afterwards will result in injury to the part reheated.

Nothing will be gained by any attempt to produce an actual weld before the operator is able to produce a neat ripple on the surface of the metal following a straight line twenty-four inches in length.

There is a tendency with beginners to experiment with various kinds and thicknesses of metal, all of which consumes time and should be devoted to the work in hand and delays their progress. It is as essential for the welder to master the "ripple" as it is for the typist to master the "touch system."

Back-fire or Flash-back

Non-flash torches are so constructed that a partial obstruction of the tip will create a slight explosion, the force of which will remove whatever obstruction is blocking the orifice. The flame will then relight and welding may be continued without interruption.

Most flash-backs, however, are caused by improper regulation of the welding flame, and particularly in those torches which use oxygen pressure in excess of that carried on the acetylene lines. Increasing the proportion of oxygen to that of the acetylene increases the speed with which the flame will travel backward to the point of combination of the two gases.

The flow of acetylene is controlled by regulators which operate on the diaphragm principle. It requires just so many ounces pressure against the diaphragm to move it. Now, if the pressure at the acetylene regulator is very low, say only one-half pound, it may be possible that under certain conditions it will fall to one-quarter pound before the diaphragm operates. This means that the amount of acetylene supplied to the torch may be reduced one-half, which is almost certain to produce a flash.

With higher pressures, say five pounds, the same reduction of one-fourth pound in pressure reduces the volume of acetylene supply but 5 per cent. which is hardly noticeable. The remedy in all such cases is obvious. Carry higher acetylene pressures at the regulator and control the flow of gas by means of the needle valve on the torch.

Another Trouble-Brewer

Another cause of trouble is the use of cylinders or generators too small to supply the welding torches in use. The use of a welding tip with an hourly capacity greater than one-seventh the capacity of the cylinder from which the acetylene is drawn, results in the drawing from the cylinder of some of the acetone (the liquid in which the acetylene is dissolved). This causes the amount of acetylene supplied the torch to fluctuate and produces a flash. Remedy: Use larger cylinders or manifold two or more of them together.

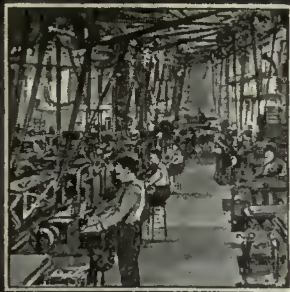
Other torches flash when two combining points of the two gases become hot. This is often due to the use of imperfect seals, in which the heating of one part produces an expansion which results in the leakage of one of the gases past the seals which should separate them. Only where the taper of the seat is sufficiently gentle, is sufficient compression to prevent such leakage possible.

Surfaces Examined

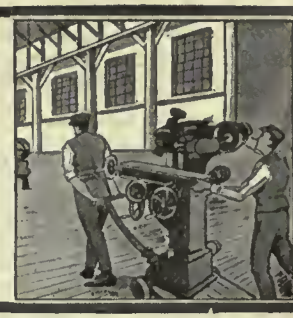
When frequent flash-backs occur, which cannot be otherwise accounted for, the seating surfaces should be examined, the leak found, and the parts ground, filed or machined to fit. This should be done under the personal supervision of the operator or some competent person, who must see to it that no oil is used on any part of his equipment. Oil used where it may come in contact with oxygen under pressure may cause a serious explosion.

If the torch is held at the proper angle it rarely occurs that the internal part of the tip becomes hot enough to ignite the gases. It is quite probable

Continued on page 58



DEVELOPMENTS IN SHOP EQUIPMENT



VARIED LINE OF HOLDERS

The Eclipse Counterbore Co., Ltd., Walkerville, Ont., have placed on the market a full line of holders, pilots, core drills, countersinks, counterbores, cutters, and special tools.

The feature in connection with the holders made by this concern is that there are no screws, balls, springs, plugs, or in fact any loose or moving parts connected with the driving. The transverse driving pin construction is designed in such a manner that the stress is distributed along the entire length of the pin instead of a single point contact as in the ball or set-screw drive. These holders are made in both standard and adjustable lengths.

When using the adjustable type holder it is not necessary to select cutters of the same length, for all one need do is re-sharpen the cutter and extend length of holder to conform to the desired depth. This feature is especially valuable on multiple spindle machine work.

For turret lathe work, etc., the holders are made with straight shanks as this style is most convenient.

Their line of safety holders are adapted for use in quick-change chucks, eliminating the necessity of purchasing collets. To go into details regarding their counterbore cutters and other varied lines without illustrations is impossible, so that, if interested in any of the style tools already mentioned, we would suggest you enquire for catalogue covering the same in detail.

THE MASON-WIDMER DRILLING MACHINE

The Arthur C. Mason, Inc., Hamilton, N. J., has placed on the market a heavier type of sensitive drilling machine which is illustrated and described herein.

The spindle on this machine is entirely equipped with:

Ball-bearings throughout, and is self-oiling. It is made of tough spindle steel of high tensile strength, accurately ground, of extra large diameter, containing the thrust and radial ball-bearings in which the spindle is mounted. A reservoir in the sleeve contains enough oil to lubricate the spindle for one week.

The spindle feed handle is extra heavy, and is especially mounted in order to prevent any looseness, and to remain fixed in any position convenient to the operator.

GENERAL VIEW OF MACHINE.

The head is of ample strength and contains a simple quick change belt shifting device. The complete range of speeds may be obtained in less than two seconds, the belt being shifted by shifter forks, so arranged as to have a reciprocating movement, which hugs the pulley closely and prevents the belt from turning over. It is operated by a crank handle in front of the cone pulley, and directly underneath the dial showing the proper speeds for the various sizes of drills. It is only necessary to give this handle one complete turn for any one of the speeds. On each turn the belt shifters are positively locked in place, insuring proper tracking of the belt, and no wear due to the belt dragging on improperly placed shippers.

On this head the four-step cone pulleys are so mounted with their own self-contained ball-bearings, that they can be removed without disturbing adjacent parts.

The slack in the horizontal belt is automatically taken up by two ball-bearing idlers, so arranged that they adjust themselves to the load as it is applied to the belt, in such a way that the belt is under tension only when the load is applied. This means extremely long life to the belt and a minimum amount of wear and tear on the machine as a whole.

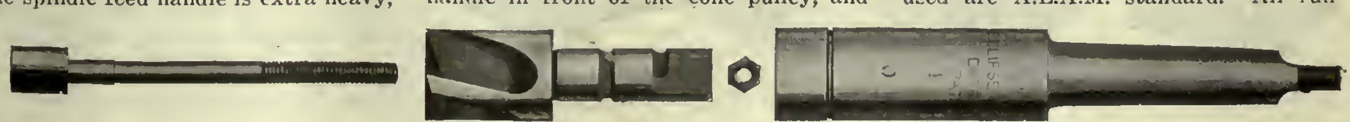
The spindle bracket is of rigid construction and clamped on the dovetail of the column with a simple screw clamp.

The table is elevated and lowered by a telescopic screw, geared to a crank handle shaft, so arranged that it is not necessary to bore a hole through the floor to accommodate the screw. The table is clamped to a substantial dovetail on the column, and it has a generous channel on all sides to gather chips and compound.

The driving mechanism is a tight and loose pulley arranged for either foot or hand belt shifter on a horizontal shaft, and transmits the power through a pair of bevel gears to the vertical shaft, running in a bath of oil enclosed in a substantial case. The back vertical shaft is so mounted with its gear, that it can be removed without tearing down the whole driving mechanism.

The "Safety First" feature has been fully carried out in the design and in the attachments.

The machine can be so arranged that it can be made a plain drilling machine with four instantly obtained speeds, or second, as a single speed purpose machine, or for a tool room machine with an additional multiplicity of speeds. Automatic power feeds can be arranged on any spindle alternating with built-in tapping attachments. All screws used are A.L.A.M. standard. All run-



VIEW OF DRAW BOLT, COUNTERBORE AND HOLDER ning parts are equipped with S. K. F. ball bearings. Pump and piping can be furnished for all machines. Motor-driven machines can be obtained with either vertical or horizontal motors.

"SAFETY" SWITCHES

SAFETY SWITCH SHOWING MECHANISM.

THE "safety" switch is one of the ramifications of the safety movement that has gained such tremendous headway in the last few years. It is common sense to prevent accident to life and property, because it is a matter of human decency and because it is a paying investment. The proper safeguarding of points where accidents are liable to happen and the proper protection of mechanisms, which in themselves are potential danger hazards also, means better insurance rates and fewer law suits. Industrial plants are pretty well in touch with the situation, having learned through real experience the need to protect life and property at every turn of the wheel. They do not think so much in terms of first cost as in terms of safety and the secondary expense of accidents.

One of the hazards to which attention was early drawn was the open knife switch, and to-day these are almost a thing of the past, insofar as industrial plant applications are concerned. It is now customary to enclose switch and fuses in steel boxes, so arranged that switch operation is possible from the exterior.

A switch externally operated may suggest to a man that he should throw off the switch before he puts his hand in the box, but an interlocking safety device, which prevents his opening the box until the switch is off makes him keep his hands away from live switch blades.

This latter accident prevention feature has been developed by the Trumbull Electric Mfg. Co., Plainville, Conn., in a line of externally-operated switches recently placed on the market.

By reference to the accompanying illustrations a very good idea of the arrangement of these switches may be gained. The box cannot be opened until the switch is in the off position. A catch prevents the switch from being closed with the box open, although the catch can be manipulated by a tool if necessary to close the switch with the box open for inspection, by an experienced man. It will thus be seen that with fuses and blades always dead whenever the switch is exposed, the fire and shock hazard are eliminated.

All single throw switches are equipped with an outside handle stop as a means of indicating when switch blade is in full contact. A further advantage is seen in the fact that the switch can be locked open.

There is a growing demand for a safety switch with quick make, as well as quick break, particularly where a careless operator might neglect to follow the handle through and so leave the blade in partial contact with the jaw post. The switches shown in our illustrations are equipped with this feature. A further device is seen in one of the types illustrated where a "100 per cent. safety shield" is shown. This is a further protection to the operator or electrician when the cover is open for fuse replacement.

Secured Contracts.—The Mackinnon Steel Co., of Sherbrooke, have recently received the following orders: Steel work for a skating rink at Bathurst Lumber Co., Bathurst, N.B.; steel work for new store for C. O. St. Jean, Wellington Street, Sherbrooke, Que.; J. W. Gregoire, architect; A. Dion, general contractor, Sherbrooke, Que.

VIEWS SHOWING SAFETY SWITCH OPEN AND CLOSED AND WITH COVER OPEN SHOWING 100% SAFETY SHIELD.

STEEL TREATERS

Last Tuesday, April 20th, the first meeting of the Toronto Chapter of the American Steel Treaters' Society was held at the King Edward Hotel.

A large gathering was present and listened with interest to Mr. Eisenman, National Secretary of the society, who was speaker for the evening. He told the story of "Heat treatment, its past, present and future," in an interesting manner, and pointed out the need of proper steel treatment especially at the present time. "In many cases," he said, "a company would spend thousands of dollars on jig and tool equipment, in order to make their product interchangeable, and then go to work and place their heat department in some pokey corner, and forget all about them."

He emphasized the need of manufacturers realizing the important fact that their product was made or marred in their heat treating department. He stated that it gave him pleasure to be able to say that this fact was being recognized more and more every day and that the old secretive method of conducting the heat treating department, was being done away with.

"If you have a dollar and I have a dollar, and we swap dollars, we each have a dollar," said Mr. Eisenman, "but if you have an idea, and I have an idea and we swap ideas, we each have two ideas. That in brief is the object of the society. By meeting together and swapping ideas, you each know more than you did before, and therefore are better men."

After his talk, those present were invited to join the society, and a large number were enrolled. No doubt every reader has read the aims and purposes of the society in last week's issue, so that if interested in any way fill in the coupon below and send it to this office, care of our associate editor, J. H. Moore. Remember it is not necessary that you be actually engaged in the heat treating business to become a member, for if you are interested in any way in the heat treatment of steel, this qualifies you for membership.

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PRINCIPAL CONTENTS

Standardization Again

THE agitation for the standardization of parts of agricultural machinery still continues at Ottawa. Like many things that go on there, it is done without a working knowledge of what the programme would entail.

Standardization of certain parts, such as bolts, nuts, threads, etc., so that they can be interchanged, should be made compulsory.

Further than this the making of laws to compel standardization is simply a lot of monkey work that will make good election stuff in rural ridings.

Makers of farm implements have thousands of machines all over the world. They agree to supply duplicate parts of any of these. It is a safe estimate that some of the large companies with a number of lines would have anything from 25,000 parts and up. They have a tremendously intricate system for stocking and shipping these. A move that would disrupt this work, throw the patterns and stock out and interfere with patents, would double the price of machinery instead of cheapening it.

This business of standardization is something that farmers themselves have never followed out. Were a buyer of sheep, cattle, horses or seed grain, to come into this country, he would have to scratch all over the place in order to get a shipment of one well-defined and clearly specialized kind.

And yet we don't hear of any agitations at Toronto or Ottawa to compel farmers to standardize in certain communities in regard to their product.

The tinkers had better turn their efforts to something about which they are qualified to speak.

The Wearing of Overalls

THE wearing of overalls is not going to help cheapen living.

Such a move is a flash in the pan. If you put on overalls for the purpose of getting out and growing a few bushels of potatoes it may get you some place.

If you put on overalls simply for the purpose of protesting against the price of clothing, you will land only one place—in a heap.

The occasional spasms that come over us to do something out of the ordinary accomplish little.

The overall fad may have been engineered by overall makers who want some cheap and efficient advertising.

If your putting on overalls means that you are seriously and honestly going to get down to hard work—then put 'em on, and glue them on.

But for the fad idea of cheapening the cost of clothing in this way—forget it.

Canada's Trade Balance

CANADA needs to get busy and produce in order that she shall have something to sell.

There is something radically wrong with a people living in such a country as this, who import more than they export.

It is a mighty poor tribute to the brain and muscle of the people, and a forceful commentary on their hit-and-miss habits.

Here are the figures for the past seven years:—

	Exports	Imports
1914	$ 431,588,439	$ 618,457,144
1915	409,418,826	455,446,312
1916	741,610,638	507,817,159
1917	1,151,375,768	845,356,306
1918	1,540,027,788	962,543,746
1919	1,216,443,806	916,429,335
1920	1,239,492,098	1,064,516,177

If Canada is to learn the lesson the exchange rate should have taught her, there will have to be a changing around of some of these figures.

Shorter hours and less output will never do it.

Ode to a Potato

THE grocer man is sellin' spuds at a dollar for a peck; it causes me to have a pain located in my neck. And there they set, them scabby things, them skinny-lookin' scuds, a-throwin' on all kinds of airs for common things like spuds.

Why, say, you spud, I well can mind not many years ago, I worked to keep your kin alive with sprinklin' can and hoe.

I used to pick ten thousand bugs from off your family tree, and now, you scabby faced galoot, you make a face at me, and claim to be worth six times more than was your former price when I was rescuin' your like from tater bugs and lice.

When I worked in a grocery store, way back in '65, we sold all sorts of truck and stuff to keep the folks alive; when in them times, you scabby thing, you wizzled, freckled sprout, we used to stick the like of you upon the oil can spout.

You make me sick, by heck you do, you aint no friend of minewe used to toss the likes of you to fatten up the swine.

You think you're smart, you cross-eyed spud, you wall-eyed scaly thing, for bouncin' up the price of eats 'tween summer and the spring. I'll gorge myself with punkin pie, with turnips and with cheese, and eat enough of these here things to make me snort and wheeze, while you at 15 cents a quart are worth more than I've got, and you can sit right there, old top, until you durned well rot.—"Ark."

MARKET DEVELOPMENTS

Big Spread Exists in Selling Prices of Steel

Independents Are Still Well Above the Prices Charged by the Corporation—Old Country Lines Are Making Better Showing and Are Reaching Here More Freely Now

THE market now has the peculiar spectacle of the United States Steel Corporation selling its output at a price many dollars a ton lower than the independents. Just how long this can be continued is hard to state, but the fact remains that with the steel markets of the world empty, the premium business is likely to last for months yet. The Corporation no doubt figures that in the long run it will be in a strong position by not having engaged in any gouging of the market when the demand was at its highest and supplies at the lowest.

Makers of machine tools in several points announce increases in selling prices. The trade has ceased to figure out when this is going to end or where it is going to lead. It is known, though, that there are large schemes in mind in this country, but work on them is hung up for the present, the promoters fearing to go into the machine tool market and engage on the building operations that would be necessary.

The scrap metal market is dull. Lead is lower in price, the reason apparently being that lead from the Old Country is likely to be on the U.S. market before very long at a figure below the prevailing price. Tea lead is also lower. The latter, by the way, has a variety of experiences, from the grocery store over the package of tea to the house, to the garbage pile, to the dump, and then rescued by the pickers. At least that is where much of it comes from.

Old Country importers report that shipments are coming through better, and they expect that with the opening of the St. Lawrence to Montreal this will be more noticeable.

BRITISH GOODS COMING IN ON MONTREAL MARKET MORE FREELY

MONTREAL, April 29.—The disturbed railroad conditions that have prevailed in the States during the past few weeks have been reflected in this district by the inconvenience that dealers have experienced in obtaining supplies from American mills and manufacturers. It is believed that the railway strike is nearing an end, but the disorganization resulting from recent unsettled conditions will prevent a return to normal movement for some weeks. The near approach to May-day has not aided in dispelling the uncertainty that is on the minds of many regarding the possible attitude of labor during the next two weeks. Until this doubtful period is over it will be impossible to give any definite assurance regarding the betterment of trade in general. There is little encouragement in the reports of dealers here as to the steel situation, and many claim it is as difficult to get material just now as it ever was in the past. Plates and tubes are very scarce and warehouse stocks on these lines are practically nil. The supply of sheets is not sufficient to meet even the most moderate requirements and consumers have to be content with the allotment that is accorded them. A factor that has been added to the problem of securing American made product is the attitude of the United States railroads that are carrying goods to Canada. Effective May 1st all consignments of material or equipment to Canada must be paid for in American currency. With goods going to the United States the charges are collected at the destination, so that Canada suffers in either case by the high exchange rate still prevailing. It is thought that some action may be taken by shippers here, but it is not likely that any concessions will be made, and the only logical solution will be an increase in the prices of affected commodities proportionate to the rate of exchange against Canadian currency.

Metal Demand Easier

The week has been comparatively quiet in the metal market and dealers' reports indicate that present demand is slightly below normal. The general tendency is to lower prices. Tin has declined and is now quoted at 73 cents per lb. Spelter shows a falling off and the price of 12 cents shows a drop of ½ cent per lb. Lead, after a brisk period, has again quieted down and quotations are easier at 11½ cents per lb.

Little Improvement in Delivery

Machine tool conditions are hardly more promising than they have been for many weeks past, the uncertainty of delivery continuing to be the outstanding feature of the present situation. Many builders of machinery are willing to place orders on the books, but the indefinite nature of the shipping date does not encourage customers in the placing of orders, as the needs in many cases are for immediate and not the distant future. Dealers in used equipment continue to repart a steady business and demand for supples and machine accessories keep the dealers busy in locating and delivery of the same. British goods are coming to hand steadily and the reopening of the Montreal service is expected to give still better delivery from across the Atlantic.

Steel Scraps Active

Apart from the slight reduction in the volume of business passing there is little to indicate a change in the old material situation. During the past week there have been some fluctuations in non-ferrous scrap quotations, but the latest reports are to the effect that the market is steadier. Coppers were inclined to weaken early last week, but strength has apparently returned and prices are firm. Lead developed a strong tendency last week but has again declined to the price of a week ago. Zinc scrap has declined and is quoted locally at 6¼ cents per lb., a drop of ¼ cent on last week's quotation. The bulk of present movement is in the iron and steel lines, but the market is not exceptionally active and quotations remain steady on the majority of scraps. The scarcity of machine scraps is still pronounced and prices continue strong. Dealers here are quoting the average figure of $33 per ton on machinery scrap. Car wheels are in greater demand and the shortage has advanced the price to $26 per ton. Stove plate at $26.50 is active, this price being an advance of $1.50 per ton.

WORLD'S MARKETS ARE STILL EMPTY

And From That Basis It Is Figured That Lower Prices Are Not Coming To Pass Yet

TORONTO.—Although some manufacturers intimate that they are now holding back on account of prices of tools, there is not much to encourage the belief or supposition that they are going to get a cheaper outfit by holding off. Just this morning the mail contained announcement of several advances in prices, and this morning was not particularly different from any other morning in that regard.

There is a very fair amount of business being placed in places that are not generally regarded as good for the metal working machinery trade. Textile mills are buying machinery in several cases, in order to keep their plant in shape, or to bring out special machines for their own use, or the making of attachments and new devices to their existing plant.

This general buying is reflected in other ways. Deliveries are not encouraging in the matter of the small motor. On the large type one can get better service, but there seems to be no chance of getting on top of the demand that keeps up for the small and average size motor. There has been an advance in the price of these in United States, and it has been thought that the movement would find its reflection in the same way here, but so far there is nothing to indicate that this is going to be the case.

There is no outstanding large business in small tools and supplies just now. The railroads, usually large purchasers, have some lists out, but they are small in comparison with their ordinary requirements. Prices are holding firm now.

An Empty Steel Market

One large dealer has addressed a letter to his customers, in which he makes use of the following:

"Our customers will, I feel, be interested in what our principals tell us from time to time about world-wide steel conditions. An extreme shortage has existed for a long time and there appears to be little relief in the immediate future. The rehabilitation of the railways and their urgent requirements long overdue for additions and repairs to rolling stock would alone tax the capacity of the mills were they not already called upon to meet a demand far in excess of the possible production. The accumulated demand for steel in the United States is far greater than it was before the war. There is practically a cessation of European activity in the steel business. Production in Great Britain is still far below normal due to a variety of causes and their home demand is so great that in some lines, the British mills are fully booked up for the whole of the present year. Germany has ceased to be a factor in the steel export situation and cannot enter in to the export business for at least a year or two. The work of reconstruction of the steel mils of France and Belgium is proceeding as rapidly as can be expected under the circumstances, but no immediate tonnage will be available for export from these countries for a considerable time to come. It would therefore appear beyond reasonable doubt that the world's demand for steel products will continue to exceed the possible supply for at least a year to come and probably for much longer. Absurdly heavy premiums have already been exacted for such small quantities of steel as are available for prompt shipment, or obtainable within the next few months. Our principals, however, strongly deprecate this kind of profiteering. Prices for the limited tonnage which we expect to get for the balance of this year will be pretty much the same, or possibly at moderate advances."

A Dull Scrap Market

Right now there would seem to be a good time for factories having anything in the line of scrap to get it sorted and put on the market. Material that will sort as stove plate, heavy melting steel and cast iron scrap will bring a good price. In fact prices published in the old material table for these three lines are more or less nominal. Scrap metal dealers claim that the steel companies are to blame for the shortage in heavy melting by allowing nearly all of the shell steel of the Imperial Munitions Board and the U .S. Ordnance Department to get out of the country. Much of it went to Britain and most of the remainder to United States. Steel mills are now in the market, and are paying much higher prices for material no better. The scrap men claim that the taking of all this material out of the country cleaned up the available stuff in Canada, and the market has been empty ever since.

Lead is weaker this week, also tea lead. The lead, as a general thing, has a variety of experience before it comes back to the scrap market. Most of it is used in making up packages for tea. Then it goes to the garbage tin, and gets a ride to the dump. Here the pickers gather it up and turn it back to the scrap metal dealers. Lead prices are inclined to sag both here and in United States just now. It is expected that English copper will be on the U.S. market before long at prices slightly below those prevailing. None of this material has been shipped across since the early stages of the war.

POINTS IN WEEK'S MARKETING NOTES

The switchman's strike gets the steel mills both ways. It may shut off raw materials, or, failing, sending cars may clog the mill with finished material.

The U. S. Steel Corporation, it is estimated, makes 44 per cent. of the finished steel in the States.

The independents continue to sell at prices $15 per ton and more than U. S. Steel Corporation prices.

English lead may soon be on the U. S. market, and at prices below the present figures.

This is a good time to dispose of anything that will grade as stoveplate, cast iron scrap or heavy melting steel.

The local scrap metal market is doing only a fair volume of business, brass and copper being weak. Iron and steel scrap are wanted, but the supply is poor.

Two American makers of machine tools announce increases in prices this week.

Montreal reports that shipments of Old Country goods are coming in more freely, and an improvement in this line is looked for with the opening of navigation.

NEW YORK RECORDS MORE ADVANCES

But Deliveries are Pretty Well Tied Up On Account of Railroad Strike

NEW YORK, N. Y., April 29.—Considering the handicaps due to the demoralization of railroad transportation, machine tool business keeps up a very fair rate, particularly in the East. Shipments are held up at many machine tool plants and it is evident that promises of delivery cannot be kept. Some manufacturing plants are in a bad way due to shortage of material, machinery repairs, etc.

The General Electric Co. has purchased the shell manufacturing plant of Bartlett-Hayward Company, Baltimore, Md., and will convert it at once into a manufacturing plant for some of its products. A part of the machine tool equipment bought for the new Bridgeport, Conn., plant is being delivered to Baltimore.

The U. S. Roller Bearing Co., a new concern, with offices in New York, is buying tools for a new plant at Manahquan, N. J.

The Automatic Straight Airbrake Co., another new concern, is buying tools for a plant at Eleventh Avenue and Twenty-Sixth Street, New York City. Purchases are being made by George W. Goettals and Co., New York.

The Mergenthaler Linotype Co., New York, has an inquiry out for a list of tools. The Simms Magneto Co., East Orange, N. J., and the VanSicklen Speedometer Co., Newark, N.J., continue to buy.

The Columbia Graphophone Co., Bridgeport, Conn., has arranged for financing of $4,600,000 for new plants at Baltimore, Md., and Toronto, Ont. Practically all of the equipment for these plants was bought several weeks ago.

Two leading makers of milling machines have advanced prices about ten per cent.

INDEPENDENTS ARE SELLING IN ADVANCE OF CORPORATION FIGURE

Special to CANADIAN MACHINERY.

PITTSBURGH, April 29.—Transportation conditions as affecting the iron and steel industry of the Central West have been little better in the past week than in the first week of the rail strike. Current reports of the strike waning are somewhat exaggerated, and in any event apply to districts in which the iron and steel industry is least interested.

Between one-fourth and one-third of the iron and steel production of the Central West is cut off, but in the East production is almost normal, while the South is scarcely affected at all. The chief cause of the curtailment is lack of coal or coke, or both, but in one or two instances there is a shortage of iron ore. If prolonged, the strike would cause curtailment by the mills becoming choked with finished products, but thus far the situation in this respect is not serious. In the early part of the strike the mills found enough empty cars to load their current product, and only in the past week has there been much piling of steel.

The movement of coke from the Connellsville region has been reduced to relatively small proportions, but there has been some movement, and there is more now than a week ago. Only a few channels are open. There is a fairly free movement from Connellsville to Buffalo, where the merchant furnaces are operating almost normally, though the New York Central is not moving any coke to that point. Some solid trainloads have been made up and moved to the Youngstown district, particularly to the Republic Iron & Steel Company. There have been various other special movements. The railroad yards in and near the coke region are now congested and while the yards are now almost fully manned the movement is slight.

Shipments of steel are of course curtailed much more than the production. Illustrating the extreme, the Jones & Laughlin Steel Company, one of the very largest independents, with two plants in the Pittsburgh district, has had practically normal production but has shipped scarcely any steel. It loaded no less than 1,500 cars before the supply ran out, then beginning to pile steel, but the cars either stayed on company sidings or moved out to main line sidings near at hand.

The great curtailment in shipments of steel does not seem to have incommoded consumers as much as would be expected. Some consumers, of course, have their own operations curtailed by the strike, and do not need as much steel as usual. Others, perhaps, are operating on stocks, though it was claimed in many quarters consumers did not have stocks.

The rail strike has had practically no effect upon the pig iron and steel markets. They are neither stronger nor weaker as a result of the strike, and while they are dull it is a question whether this condition is attributable to the strike.

Price Prospects

There is no material change in the steel prices, and there has been none of consequence for several weeks. This does not mean, however, that there is no change in the market as to the strength of prices or as to the prospects. There is and has been an unprecedented situation and naturally there are unusual consequences. It is absolutely unprecedented. for nearly half the the steel (the Steel Corporation according to the latest statistics makes 44 per cent. of the country's finished steel) to be sold at one price and the remainder to be sold at much higher prices, most of it $10 to $15 a ton higher, with the small remainder at higher prices still.

It might have been expected that when the buying pressure should decrease the prices asked by the independent producers would decline, but the independents have elected not to reduce prices. This is individual, not collective, action since the producers have no conferences with each other. Evidently the large independents felt that reducing their prices would discourage buyers from taking hold, the alternative being to adhere to any prices attained and let buyers take what they would. The general alignment of the market has been that the nearer the delivery the higher the price. Hence if a mill has a certain price and sells at only two-thirds the rate at which it ships, it gradually becomes able to make earlier and earlier deliveries, and the price becomes more attractive to the buyer. This will work all right for a time but when the mill got entirely caught up on deliveries something would occur.

Some of the large independents state positively that they have not regularly opened their order books for third quarter business, though of course, they have taken some orders from special customers, and they would probably will have a little lapover from the second quarter. The smaller independents, that have had still higher prices, on account of delivery, are naturally sold still less distances ahead. The Steel Corporation's unfilled obligations at the end of March amounted to 9.892.075 tons. having increased by 389,994 tons during March. Even assuming a smaller rate of increase since the beginning of this month, there would be say 10,100,000 tons now on books. At the corporation's recent rate of shipping this tonnage would be equal to shipments up to the middle of next January, this being merely an average period since some products are sold much further ahead than others.

The divergence between the order books of the Steel Corporation and the independents is therefore very great. Nothing like such a situation has ever obtained in the past. While many of the smaller producers do not usually sell far ahead, the large independents, like Republic, Lackawanna, Jones & Laughlin, and others, have in the past sold for practically the same periods as the Steel Corporation. Not only is there this remarkable divergence, the divergence is increasing, for the Steel Corporation is selling more than it is shipping, while the independents as a whole are selling less than they are shipping. Out of this condition something very interesting will have to develop, and in the not distant future. Unless there is a sudden and large increase in consumptive demand the independents will eventually be looking for business, and they can hardly get it by cutting prices to buyers who have been patronizing the Steel Corporation as buyers will remember the circumstances of the past few months.

Pig Iron

The interesting question has been presented whether the rail strike has made pig iron scarcer or more plentiful. Obviously it has made it scarcer at some points and more plentiful at others, but the general balance is a matter of doubt. It is clear that pig iron production since the first of the year has been greater than was expected, that the productive capacity is still greater than the recent production, and that some classes of consumers cannot afford to pay the prices now being asked. From the present outlook it seems reasonably certain that pig iron will decline before it advances, but there may be no important changes in quoted prices for quite a while, the furnaces being content to do without sales, merely shipping against the large volume of contract business they have on books. The valley market remains quotable at $42 for Bessemer, $41.50 for basic and $43 for foundry iron, f.o.b valley furnaces, freight to Pittsburgh being $1.40.

The Week's Events in Montreal Industry

The pontoon recently completed and launched at the yard of the Davie Shipbuilding Company for the Canada Steamship Lines, and which will be used as a landing stage for the company's steamboat service at the port of Quebec, will be the largest of its kind in the world, being 225 feet in length and 45 feet wide.

In anticipation of the abnormal demand that will be made this season on the accommodation of the hotels of the city, the directors of the Ritz-Carlton Hotel of Montreal are contemplating the erection of an additional wing to the present building that will add about one hundred rooms to the existing structure.

H. J. Griswold, who in May, 1918, was engaged from the Dominion Engineering and Inspection Company to organize and operate the Canadian branch of MacGovern and Co., Inc., of New York City, is completing a two-year contract on June 1 and then will resume active participation in the affairs of the Dominion Engineering and Inspection Company, in which he is a partner.

Recent Department of Marine estimates that have been passed by the House includes items of $1,500,000 for the maintenance and repairs to Dominion steamers and ice-breakers; $478,000 for dredging in certain portions of the St. Lawrence River between Montreal and the sea; $2,000,000 for the construction of a new ice-breaker to be used on the St. Lawrence. This last amount is for a vessel of 8,000 horsepower and will have a crew of about ninety men.

The first ocean arrival to the Port of Montreal this season was the Canadian Government Merchant Marine steamer, "Canadian Aviator," which docked about noon last Sunday, this arrival announcing the formal opening of navigation on the St. Lawrence. In accord with previous custom, Capt. Hilton, who was in command of the vessel, will be entitled to the gold-headed cane or other recognition that is generally presented to the captain bringing in the first ocean vessel.

A petition bearing some 14,000 signatures will be presented to the chairman of the Administration Commission of Montreal this week, urging consideration regarding the changes to the building code of the city and to abolish limitations to the height of buildings. This is the outcome of the request made some time ago by a certain syndicate to build a sixteen-storey hotel on St. Catherine St., but which at that time was considered inadvisable owing to the present by-laws in this connection and the lack of adequate fire-fighting facilities for buildings of such a height.

The opening of navigation was fittingly celebrated last Saturday at the yard of the Canadian Vickers Company, when the 8,300-ton Norwegian steamer Tatjana was launched. This vessel has a length overall of 413 feet, a beam of 52 feet and a depth of 31 feet 1 inch. She is fitted with triple expansion engines and three Scotch boilers, adapted to burn either coal or oil fuel, the boilers being equipped with Howden's forced draught system. The sponsor of the vessel was Mrs. Hans Johansen, wife of the chief surveyor of Norwegian Veritas in the United States and Canada.

The American Waterworks Association will hold its 40th annual convention in Montreal from June 21 to 24, with headquarters at the Windsor Hotel, the Windsor Hall being reserved for an exhibition display, where many American and Canadian manufacturers of waterworks equipment will have exhibits. The meeting will bring many prominent hydraulic engineers from many points of Canada and the United States, and it is expected that about 1,000 delegates will be in attendance. Extensive plans are now in preparation for the professional meetings and entertaining features. H. G. Hunter, of Montreal, is the chairman of the entertainment committee.

The Administrative Commission of Montreal are again proposing that the City Council accept their suggestion for the adoption of a by-law relative to the compulsory installation of dry sprinklers in the basement of all public and other large buildings. The first suggestion as originally drawn up included dwelling houses, but in the revised form this class of building has been exempted. The purpose is to provide more adequate facilities for fighting fires where the nature of the material would produce noxious gases and suffocating fumes: the proposed method enabling the firemen to connect the hose and drench the interior without danger to themselves.

The formation of the Dominion Engineering Works, Ltd., represents another enterprise of the Dominion Bridge Company, and the new organization, which will take over the present holdings of the Dominion Engineering and Machinery Co., a subsidiary of the Dominion Bridge Co. inaugurated last fall for the manufacture of paper-making machinery. The new company will, in addition to the manufacture of paper machinery and turbo equipment, engage in the production of all classes of heavy hydraulic and hydro-electric power equipment. The plant of the old St. Lawrence Bridge Company will be utilized for the new enterprise. In addition to Dominion Bridge interests, many business men associated with large pulp and paper industries and of hydro-electric developments and power companies are on the personnel of the newly-formed board of the new concern.

An interesting and impressive demonstration of fire-extinguishing was given last week on the Champ de Mars in Montreal by the Canadian Foamite Firefoam Company. The extinguishers are very similar to many others, but the difference is in the effect of the combination of the two chemicals. When these are combined—by inverting the container—the result is to generate a coffee-colored foam full if minute bubbles, which contain carbon-dioxide gas, the deadly foe of combustion. The foam produced by the mixture of the chemicals has a volume eight times that of the original contents. This foam will not mix with water or oils, but floats or clings to any surface it hits, and completely smothers the fire. Several tests were made in direct competition with soda and acid mixtures, and in every instance the Foamite showed its superiority over the other extinguishers. The first test consisted of a tank seven feet by six, filled with ten gallons of crude oil and gasoline. Two ordinary soda and acid extinguishers were first used, and the fire was put out in 46 seconds, but the same quantity of Foamite put it out in 26 seconds. A wall fire contrived by the erection of a wooden door, eight feet high by four feet wide, with two burning strips twenty feet long, all drenched with oil, took two of the soda and acid extinguishers 56 seconds to put out. Half the quantity of Foamite put it out in 20 seconds. A circular tank with ten gallons of oil and gasoline took Foamite 21 seconds to put out. The most exciting test consisted of a pan, five feet by four, surrounded by a wood pile and filled with water and oil. The ordinary extinguisher utterly failed; Foamite had it out in a few seconds. The final test was on a large pile of wood, hay, barrels, and other material, all saturated with oil and gasoline, on which a 40-gallon extinguisher was used. The fire was put out in about 20 seconds, with plenty of foam to spare.

The death took place at Brantford of Major T. Harry Jones, who for 37 years has been chief of the Engineering department of the city. He held front rank in his profession, being frequently called upon by engineering bodies to give papers on technical matters, particularly on roads. He was a member of the Corps of Guides of Canada and an active member of Brant Avenue Methodist Church. A widow and a large family in Brantford, and two brothers, Col. C. S. Jones, Toronto, and A. S. Jones, K. C., of Brantford, survive.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$42 40
Lake Superior, charcoal, Chicago	57 00
Standard low phos., Philadelphia	50 00
Bessemer, Pittsburgh	43 00
Basic, Valley furnace	42 90
Toronto price:—	
Silicon, 2.25% to 2.75%	52 00
No. 2 Foundry, 1.75 to 2.25%	50 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 50
Steel bars, base, Toronto	5 50
Iron bars, base, Montreal	5 50
Steel bars, base, Montreal	5 50
Reinforcing bars, base	5 00
Steel hoops	7 00
Norway iron	11 00
Tire steel	5 75
Spring steel	10 00
Band steel, No. 10 gauge and 3-16 in. base	6 00
Chequered floor plate, 3-16 in.	9 40
Chequered floor plate, ¼ in.	9 00
Staybolt iron	9 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	4 00
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 90
Small shapes under 3"	3 62

FREIGHT RATES

Per 100 Pounds. Pittsburgh to Following Points	C.L.	L.C.L.
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

	Gross. Montreal	Toronto
Lake copper	$25 00	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	77 00	75 00
Spelter	12 50	12 25
Lead	12 00	12 00
Antimony	14 50	14 00
Aluminum	34 00	35 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 7 25	$ 7 25
Plates, ¼ up	6 50	6 50

PIPE—WROUGHT

Price List No. 44—April, 1920.

STANDARD BUTTWELD S/C

	Steel Black	Steel Galv.	Gen. Wrot. Iron Black	Gen. Wrot. Iron Galv.
⅛ in.	$6 60	$ 8 60	....	....
¼ in.	6 13	7 26	$ 5 43	$ 7 66
⅜ in.	6 13	7 26	5 43	7 56
½ in.	6 84	8 42	7 27	8 84
¾ in.	8 45	10 58	9 03	11 16
1 in.	12 60	15 64	13 35	16 49
1¼ in.	16 91	21 16	18 06	22 31
1½ in.	20 21	25 30	21 69	26 68
2 in.	27 20	34 04	29 05	35 89
2½ in.	43 00	53 82	....	....
3 in.	56 23	70 38	....	....
3½ in.	71 30	88 32	....	....
4 in.	84 48	104 64	....	....

STANDARD LAPWELD S/C

	Steel Black	Steel G lv.	Gen. Wrot. Iron Black	Gen. Wrot. Iron Galv.
2 in.	$30 90	$37 74	$34 60	$41 44
2½ in.	45 34	66 16	51 19	62 01
3 in.	69 29	73 44	66 94	81 09
3½ in.	73 14	90 16	82 34	99 36
4 in.	86 66	106 82	97 66	117 72
4½ in.	0 98	1 23	1 24	1 49
5 in.	1 16	1 44	1 44	1 73
6½ in.	1 49	1 86	1 87	2 25
7 in.	1 94	2 43	2 42	2 90
8-L in.	2 04	2 56	2 54	3 05
8 in.	2 35	2 94	2 92	3 61
9 in.	2 81	3 52	3 50	4 21
10-L in.	2 61	3 26	3 25	3 90
10 in.	3 36	4 20	4 18	5 03

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.

4½" and larger 50%.

4" and under, running thread, 30%.

Standard couplings, 4-in. and under, 30%

Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$15 00	$14 00
Copper, crucible	18 00	18 00
Copper, heavy	18 00	18 00
Copper wire	18 00	18 00
No. 1 machine composition	16 00	17 00
New brass cuttings	11 00	11 75
Red brass cuttings	14 00	15 75
Yellow brass turnings	8 50	9 50
Light brass	6 50	7 00
Medium brass	8 00	7 75
Scrap zinc	6 50	6 00
Heavy lead	7 00	7 75
Tea lead	4 50	5 00
Aluminum	19 00	20 00
	Per Ton	Gross
Heavy melting steel	18 00	18 00
Boiler plate	15 50	15 00
Axles (wrought iron)	22 00	20 00
Rails (scrap)	18 00	18 00
Malleable scrap	25 00	25 00
No. 1 machine cast iron	32 00	33 00
Pipe, wrought	12 00	12 00
Car wheels	22 00	26 00
Steel axles	22 00	20 00
Mach. shop turnings	11 00	11 00
Stove plate	25 00	25 00
Cast boring	12 00	12 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜-in. and less	10
Carriage bolts, 7-16 and up	Net
Coach and lag screws	25
Stove bolts	55
Wrought washers	45
Elevator bolts	Net
Machine bolts, 7/16 and over	Net
Machine bolts, ⅜-in. and less	15
Blank bolts	Net
Bolt ends	Net
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square, blank	add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 50
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	25 and 5
Sq. and hex. hd. cap screws	22½
Rd. and fil. hd. cap screws	plus 17½
Flat but. hd. cap screws	plus 30
Fin. and semi-fin. nuts up to 1-in.	20
Fin. and Semi-fin. nuts, over 1 in., up to 1½-in.	10
Fin. and Semi-fin. nuts over 1½ in., up to 2-in.	Net
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$60 00
Open-hearth billets	60 00
O.H. sheet bars	76 00
Forging billets	56 00-75 00
Wire rods	52 00-70 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 70
Cut nails	5 85
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 35½
British Manila rope	0 28
New Zealand hemp	0 28
Transmission rope, Manila	0 47
Cotton rope, ¼-in. and up	0 88

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net

Real Bargains in Machine Tools

WE have for sale the up-to-date manufacturing plant of the Roelofson Machine Company of Galt, Canada. This enables us to offer exceptional bargains in high-grade Machine Tools in exceedingly good condition. The entire plant must be sold before June 1st, and is priced accordingly.

Look over the list—we venture to say you have never seen a better collection of high-grade machine tools anywhere—every one of them the best in its class. Immediate shipments can be made.

5—Heavy Duty LeBlond Lathes, 21" swing, 10' bed. These Lathes are double back gear, quick change gear and have pan, bed and pump.
3—22 Barnes Self-oiling Drilling Machines.
7—18" x 8' Stevens Lathes.
1—American 15" x 6' Lathe.
1—Hamilton make 14" x 6' Lathe, with taper quick change.
1—Gisholt Turret Lathe, 18" x 8'.
1—Davis Lathe, 18" x 8'.
1—Hendey Tool-room Lathe, 14" x 6'.
1—Hendey Tool-room Lathe, 16" x 8'.
The three latter have taper attachment and draw-in collets.
1—Leland-Gifford 3 spindle Sensitive Drilling Machine.
1—LeBlond Universal Grinder.
1—15" Potter & Johnston Universal Shaper.
1—No. 2-G Hendey Universal Milling Machine.

In addition there are a large number of other machine tools, also 9 in. x 9 in. Curtis Air Compressor; Frankford Furnaces, Hoskin Electric Furnace, and one each 40, 30 and 20 H.P. Westinghouse Motors. Three phase, 25 cycle, 550 volts, 750 R.P.M., with no-voltage release starters, Base and Pulley.

Plant open for inspection daily. Telephone us or write Machine Tool Department and special representative will meet you.

The A. R. WILLIAMS MACHINERY CO.

LIMITED

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Telephone Adelaide 20.

Offices at Halifax, St. John, Montreal, Hamilton, Walkerville, Winnipeg and Vancouver.

MISCELLANEOUS

Solder, strictly	$ 0 40
Solder, guaranteed	0 43
Babbitt metals	18 to 70
Soldering coppers, lb.	0 62
Lead wool, per lb.	0 16
Putty, 100-lb. drums	8 30
White lead, pure, cwt.	20 00
Red dry lead, 100-lb. kegs, per cwt.	16 50
Glue, English	0 40
Tarred slater's paper, roll	1 30
Gasoline, per gal., bulk	0 35
Benzine, per gal., bulk	0 35
Pure turp., single bbls., gal.	3 60
Linseed oil, raw, single bbls.	3 00
Linseed oil, boiled, single bbls.	3 03
Sandpaper, B. & A.	List plus 43
Emery cloth	List plus 37½
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin, "D," per lb.	0 14
Borax crystal and granular	0 14
Wood alcohol, per gal.	2 70
Whiting, plain, per 100 lbs.	2 75

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes	32½
Can. carbon cutters, plus	20
Standard drills, all sizes	32½
3-fluted drills, plus	10
Jobbers' and letter sizes	32½
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	net
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus 20 to	40
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At warehouse]

Rounds and squares	$7 base
Hexagons and flats	$7.75 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	60	75
Class B	27	37
Class C	18	27

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 8 50	$ 9 50
Sheets, black, No. 10	8 50	9 00
Canada plates, dull, 52 sheets	8 50	10 00
Can. plates, all bright	8 60	9 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	11 00	....
Fleur-de-Lis, 28 B.W.G.	10 50	....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28	....	....
Premier, No. 28, U.S.	11 50	10 50
Premier, 10¾-oz.	11 50	10 90
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅝ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	29 50
1¾ in.	31 50	30 00
2 in.	30 00	30 00
2¼ in.	35 00	29 00
2½ in.	42 00	37 00
3 in.	50 00	48 00
3¼ in.	.. ..	48 50
3½ in.	63 00	51 50
4 in.	85 00	65 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	24½
Palacine	27½
Machine oil, per gal.	43½
Black oil, per gal.	18½
Cylinder oil, Capital	82
Cylinder oil, Acme	70
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	$2 60
Union thread cutting oil, antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil, bbls., net	13½

BELTING—No 1 OAK TANNED

Extra heavy, single and double	10%
Standard	10%
Cut leather lacing, No. 1	2 75
Leather in side	2 40

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 60
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	09
Pumice, ground	06
Emery glue	30
Tripoli composition	09
Crocus composition	12
Emery composition	10
Rouge, silver	60
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE

XXX Extra	.24	Atlas	.20
Peerless	.22½	X Empire	.19½
Grand	.22½	Ideal	.19
Superior	.22½	X Press	.17½
X L C R	.21		

Colored

Lion	.17	Popular	.13
Standard	.15	Keen	.11
No. 1	.15		

Wool Packing

Arrow	.35	Anvil	.22
Axle	.28	Anchor	.17

Washed Wipers

Select White	.20	Dark colored	.09
Mixed colored	.10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades... 15%

ANODES

Nickel	.58 to .65
Copper	.38 to .45
Tin	.70 to .70
Zinc	.18 to .18

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6 x 4 base	45 00	44 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 75	$14 50
Sheets, 3½ lbs. sq. ft.	10 50	14 00
Sheets, 4 to 6 lbs. sq. ft.	10 25	13 50

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .23
Acid, hydrochloric	.03¼
Acid, nitric	.10
Acid, sulphuric	.03¼
Ammonia, aqua	.15
Ammonium, carbonate	.20
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, annhy	.41
Copper, sulphate	.16
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.08
Nickel carbonate	.32
Nickel sulphate	.19
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.25
Silver nitrate (per oz.)	1.20
Sodium bisulphate	.11
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.18
Tin chloride	1.00
Zinc chloride, C.P.	.30
Xinc sulphate	.08

Prices per lb. unless otherwise stated

Forging Ahead in Spite of Poor Conditions

Keeping Ahead With Material for Turning Out Automobiles a Difficult Undertaking—Willys-Overland Have Opened Cafeteria for Convenience of Their Weston Road Plant

A PAYROLL of 1,500 employees, an output of fifty cars per day, and the output four thousand cars behind the business booked, may be looked upon as a fair year's after-the-war business. That, in short, is what the Willys-Overland have done since they put their Overland-4 on the market in Canada as a Canadian product.

At the opening of the new cafeteria in connection with the Weston Road plant, Mr. T. A. Russell, president; Mr. J. .'. McKay, secretary-treasurer, Mr. Dover, sales manager, and other officials of the company, told of some of the troubles and triumphs of the first year's business. The cafeteria is part of the program of industrial betterment that Mr. Russell has in mind for the plant. Arangements are made whereby the men in the plant, the girls in the office or the office staff generally, can be served at a very reasonable rate, an upstairs room being set aside for the use of the girls. The cafeteria is not put up as a money maker, but as a matter of convenience to many of the employees who find it impossible to get away at noon. A very substantial meal can be secured from 25 to 35 cents, which, in these days of high prices, is a modest enough sum.

Part of the cafeteria is set aside for the use of the Executive of the company. As far as possible they intend to have their noon-day meal together. It is almost impossible to get these men together, or to reach any number of them at any time during the day, as they are often engaged or away when wanted. "But we figured," remarked Mr. Russell, "that they would all eat once a day, anyway, and we find that our guess is correct."

The story of the turning over of the plant from the manufacture of Sunbeam motors for the fighting airplanes to the making of automobiles has been told in the columns of CANADIAN MACHINERY several times. Just before the conclusion of the war, production was being so perfected that it was within reason to state that the plant was on the verge of production where they could get one of these engines every hour, developing 200 h. p., although some of them tested as high as 250 h. p. The sudden cessation of hostilities left the company with a great amount of equipment, a good organization, but nothing to produce. The work of turning to a Canadian-made car was a big proposition. It required a lot of confidence in the stability of this country to go ahead and make the enormous initial investment. Nor have conditions been favorable in the fullest sense of the word, at any time since. There were labor troubles last year, and there has been, without a let-up, a shortage of material, especially in all lines of steel, that has made it impossible to plan for quantity production as the engineers at the plant would like to do.

The Returned Man

"We have made it a rule in our plant," said Mr. Russell, "to give preference to the returned men who apply for work, and also to make every allowance for them after they get started. If they fall down for a while, we regard it as all the more reason why they need more consideration. The results we are getting from the work of the returned men are satisfactory in every way, and a number of them are now holding responsible positions." A poll of the men employed in the plant was taken recently, and it was then found that one out of every three was a returned man.

"We have kept before us the idea of having a Canadian-made car, and at every opportunity we cut down the amount of material imported by replacing it with Canadian-made. Right now the value of the imported material in each car is $120. Some of the Canadian manufacturers from whom we buy parts may get some of their raw material from United States, but as quickly as practicable and possible we are trying to reach the made-in-Canada stage. With the shortage in all kinds of material it is serious business trying to keep up the production. There are in the Overland-4 exactly 1,296 parts, and the absence of any of these will hold up production. Our purchasing department is having a busy time trying to keep the factory in anything like full operation."

Mr. Russell also intimated that the Willys-Overland company had further extensions planned on an elaborate scale, but for the present the company was undecided as to the advisability of starting a building program, and also about going into the machine tool market for the necessary equipment.

Mr. Dover, sales manager of the Willys-Overland Co., speaking of the automobile market in Canada, said it was impossible to get the production at the plant keyed up to the amount of business in sight. Unless something very unforeseen happened, there would be no chance of catching up with the business by the end of 1921. "Just take yesterday for an example," was his way of explaining the situation; "we had orders coming in for 87 cars and the output of the plant was under the fifty mark on that day due to the lack of material. That shows how bookings are piling up ahead of the ability of the plant to turn them out. The farmers are buying cars in greater numbers. In fact they are our best customers right now."

Through the Plant

Following the luncheon, a number of the party went through the plant with Mr. Fred Adams, superintendent, and Mr. H. E. Brasier, manager of the Service Department. The making of the Overland-4 has been described in detail to readers of CANADIAN MACHINERY before. The Service Department is one that would surprise the layman, owner of a car though he might be, and yet not acquainted with the workings and the system used to keep a number of every piece in all the models on hand for immediate shipments. Sections are set aside for all the older models of Overland cars, as well as the Four. There is over a million dollars tied up in parts at the Weston Road plant, and every facility is provided to give speedy service to every driver of an Overland.

Need More Attention

Officials of the Willys-Overland Co. do not mince words when they come to speak of conditions of the roads leading from the city to their plant. "It is impossible for us to send a new car from the plant to the city without getting the 'Sunday' all spoiled on it. It is either splashed with mud or buried in dust according to the season." That is the official view of the situation. "While other cities in Ontario are giving free sites, exemption from taxation, and all sorts of concessions, Toronto does not seem to think it worth while to build a decent road to industries already here, and which are enlarging all the time."

The road going to the plant at this time of the year is certainly of the pioneer type, and what little repair work has been done is crude and of no consequence.

The Sick Benefit Fund

The employees of Willys-Overland Ltd., organized their own sick benefit fund A general meeting of the men was held some few weeks ago and officers elected. They are as follows: President, A. Ellis; vice-president, J. McDonough; secretary, G. Kingsburgh; treasurer, J. Easton; trustees, W. L. Clarke, C. Glen, H. E. Brasier, H. Singer, W. Mellis, H. B. Capsey.

The levy made by the men is ten cents per week on the members. This amount is deducted from the pay, but not without the consent of the employee. Of course if the employee puts nothing in he is not entitled to take anything out.

The benefits are placed at $6 per week for sickness or accident outside of working hours, and not covered by the Workmen's Compensation Act; not to exceed

Garlock-Walker's List of Machines in Stock and for Immediate Shipment

LATHES

1—7A Cataract Precision Lathe, NEW.
1—7B Cataract Precision Lathe, with compound rest, NEW.
2—7" Cataract Precision Lathes, with attachments, USED.
1—12 x 8 Carroll-Jamieson Q.C.F., S.B.G., USED.
1—14 x 8 Carroll-Jamieson Q.C.G., S.B.G., USED.
1—14 x 6 Hamilton, Q.C.G., S.B.G., USED.
1—16 x 6 Cisco, Q.C.G., S.B.G., USED.
6—16 x 6 Reed-Prentice Single Purpose, Semi-Automatic, NEW and USED.
1—16 x 8 Reed-Prentice Plain Screw Cutting, USED.
1—16 x 8 Bradford Plain Screw Cutting, USED.
1—16 x 6 Morris, Q.S.F., S.B.G., USED.
1—18 x 8 Rae, Q.C.G., D.B.G., NEW.
1—18 x 8 Milwaukee, Q.C.F., D.B.G., NEW.
1—18 x 8 American Tool Works, Q.C.G., D.B.G., USED.
1—18 x 8 Cincinnati, Q.C.G., D.B.G., USED.
1—18 x 8 Bradford, Plain Screw Cutting, USED.
1—18 x 8 Whitcomb-Blaisdell, W.C.G., D.B.G., USED.
1—18 x 8 Morris, W.C.F., S.B.G., USED.
1—18 x 8 Flather, Plain Screw Cutting, USED.
1—18 x 10 McDougall, Q.C.G., D.B.G., Taper Attachment, USED.
1—20 x 10 Rahn, Plain Screw Cutting, USED.
1—24 x 10 Milwaukee, D.B.G., Q.C.F., NEW.
1—30 x 16 Advance, D.B.G., Q.C.G., Heavy, NEW.
1—36 x 16 Bridgeport, Heavy Duty, NEW.
1—36 x 18 Putnam, Plain, Heavy, USED.
1—50 x 40 Ryerson-Fifield, Heavy, NEW.
1—18 x 10 McDougall, Q.C.G., D.B.G., Taper Attach., USED.

TURRETS

10—No. 4 Millholland Power Feed Turret Screw Machines, Wire Feed, Cut-off Slides.
3—Davis. 24" Turrets, 2" Hollow Spindle, USED.
5—Oliver, 16" and 18", 2½" Hollow Spindle, USED.
1—Hartford Full Automatic, 2 7-16" Hollow Spindle, USED.

DRILLS

2—No. 1 Burke, 10" Sensitive Bench, NEW.
2—15" Barnes, Geared Head, USED.
1—16" Single Spindle, High Speed Edlund, NEW.
1—20" Barnes Automatic Stop and Return Feed, NEW.
2—20" Champion P.W. & L. Feed, NEW.
1—32" McKay-Bertram Heavy Duty, USED.
1—No. 314 Baker 3" capacity, nearly new.
1—No. 14 Colborn, 2" capacity, nearly new.
1—D8 Colburn Heavy Duty, nearly new.
1—4' Radial Ryerson Gear Box Drive, NEW.
3—4-spindle Woodward & Rogers, ½" capacity, NEW.

SHAPERS

1—16" Queen City Back Geared, USED.
1—16" Milwaukee Back Geared, NEW.
1—24" Steptoe Single Pulley Drive, NEW.
1—24" McDougall Back Geared, USED.

PLANERS

1—24 x 24 x 8 McK.-Bertram, USED.
1—24 x 24 x 8 Whitcomb-Blaisdell, USED.
1—48 x 48 x 14 Powell, USED.
1—48 x 48 x 18 Ryerson Multispeed, NEW, four heads.
1—30 x 36 x 12 London, one head, USED.

GRINDERS

1—No. 2 Bath Universal, NEW.
1—8 x 36 Fitchburg Cylindrical, NEW.
1—No. 1 Cincinnati Tool and Cutter, USED.
1—No. 1 Wilmarth & Morman, Universal, USED.
1—No. 1 Le Blond Universal Tool and Cutter, USED.
1—Barnes Wet Emery Grinder, USED.
1—No. 12 Gardner Disc Grinder, USED.
1—No. 65A Blount Wet Tool, Used.
1—14 x 72 Norton Plain Grinder, USED.
1—Wilmarth & Morman Wet Tool and Drill Grinder, USED.

MILLING MACHINES

1—No. 3 Ryerson-Owen Universal, NEW.
1—No. 3 Ryerson-Conradson, Plain, NEW.
1—No. 3 Ryerson-Conradson, Universal, NEW.
2—No. 3 Ford-Smith, Plain, USED.
1—No. 1 Kempsmith Universal, nearly new.
4—Type A & B "Briggs" Heavy Duty, Plain Millers, NEW.
Several Hand Millers, pedestal and bench type.

PUNCHES, SHEARS AND PRESSES

Several Small Punches and Shears. Capacity to ¼", NEW.
1—Ryerson Rotary Bevel Shear. Capacity 1", NEW.
1—Ryerson 8' Double Housing Type Splitter, Cap. ¾", NEW.
1—Ryerson Kling Punch, 1¼ x 1", 48" Throat, NEW.
1—Styles Parker Sprue Press, stroke 1¼", USED.
1—Brown, Beggs Single Crank Double Arch Geared Press, 4" Stroke, USED.
1—No. 200 Brown, Boggs Press 1¾" Stroke, USED.
2—No. 13 Stoll Plain Inclinable Open Back Presses, NEW.
1—No. 57½ Toledo Geared Press, USED.

AUTOMATICS

1—No. 2 Garvin Automatic Screw Machine Wire Feed, USED.
1—No. 2 Brown & Sharpe Screw Machine Wire Feed, USED.
1—National Acme Automatic Screw Machine, Four Spindle, Capacity 1", USED.
1—National Acme Automatic Screw Machine, Four Spindle, Capacity, 1⅛", USED.
1—National Acme Automatic Screw Machine, Four Spindle, Capacity 1 7-16", USED.
10—Cleveland Single Spindle, Capacities ¾" to 1 3-16", USED.
1—Cleveland Single Spindle, Capacity ⅜"; USED.
6—Brown & Sharpe Auto. Screw Machines. Various capacities.

ENGINES

1—21 x 30 Right-hand Heavy Duty Goldie-Corliss, speed 150 R.P.M., Rites Governor and 75' drive belt 37" wide, Tightener.
1—20 x 40 x 42 Cross Compound Goldie-Corliss Rope Drive with Condenser.
1—13 x 14 Robb High Speed Engine, with 70 K.W. Generator, 60-cycle, 3-phase, 220 V. Direct Connected, with Exciter.
1—18 x 18 Robb-Armstrong High Speed, Belt Drive.
1—75 H.P. Peerless Self-oiling Automatic Steam Engine, direct connected to 50 K.W., 220 V. Generator, with Switchboard.
1—75 H.P. High Speed "Bell" Steam Engine.

AIR COMPRESSORS

1—8 x 8 Sullivan, Belt Drive.
1—8 x 8 Bury, Steam Drive.
1—10 x 18 Ingersoll, Belt Drive.
1—10 x 10 Sullivan, Belt Drive.

MISCELLANEOUS

Beaudry Hammers, Power Hack Saws, Ventilating Fans, Roots Blowers, No. ½ and No. 1, High Speed Riveting Hammers, Portable Cranes, Chain Blocks, Vacuum Pumps, Moulding Shop Equipment, Shafting, Pulleys, Belting and Hangers.

May we have your enquiries?

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"Everything in Woodworking and Metalworking Machinery"

If interested tear out this page and place with letters to be answered

26 weeks in any one year, and in case of death $50 for funeral expenses.

Mr. Russell, after the formation of the Willys-Overland Mutual Benefit Society, wrote, on behalf of the company, approving of the idea, and by way of showing tangible sanction, offered to employees of six months' standing a 50 per cent. increase in the sick benefit and 100 per cent. in the case of a funeral, making $9 per week for sickness and $100 for funeral expenses.

FACTORIES EXTEND PLANTS IN GUELPH

Additions at Gilson's and the Malleable Iron Works, as Well as at Lang's.

Guelph. — The Gilson Manufacturing Co., of Guelph, makers of the Goes-Like-Sixty gas engines and tractors, etc., are adding a two-storey brick extension, 140 by 80 feet, to their main building, to be used as a machine shop and assembling room.

This, along with the large extension to the molding shop which has recently been completed, will put them in a better position to cope with the extra volume of work which is coming their way.

White Sewing Machine Extensions.

The White Sewing Machine Co. of Canada, Limited, have just completed some very extensive alterations to their plant, several new buildings have been added, and a considerable amount of new machinery installed. The company is now manufacturing at their Guelph plant several types of machines which formerly had to be imported from their plant in Cleveland. A very busy season is anticipated.

Second Extension in 12 Months

The Lang Manufacturing Company, Limited, general machinists, who opened their plant at Guelph in May, 1919, and who found it necessary to build an addition in the fall, have again been obliged to extend, and the foundation is being laid for an additional structure, 45 x 33 feet. The company manufactures the Guelph Convertible Seat and does a big business in oxy-acetylene welding in addition to a general line of machinery repairing and rebuilding, and are exceptionally busy at the present time. One large order which they have just filled is for convertible seats for the million dollar inn at Huntsville. These seats are so constructed that they can be converted into combination seat and dining table for picnic parties.

South African Trade—Mr. P. M. Ward, Assistant Trade Commissioner to South Africa, is of the opinion that there is a great field for Canadian manufacturers to develop an export business to South Africa. The chief lines that are needed are building materials and machinery and agricultural implements. The obstacle presented by the exchange situation was expected to be soon relieved by the arrangement with London for payments of drafts.

LARGE ADDITIONS BY BUTTERFIELD CO.

Capacity Has Been Quadrupled During the Last Four Years

The Butterfield & Co. division of the Union Twist Drill Co. have signed the contract for a large addition to their factory at Derby Line, Vermont. Buildings will consist of one three-storey building, 180 x 50 feet, and one single storey building, 180 x 60 feet. Concrete and brick construction used throughout. Contract price, $200,000.

Plans are also drawn for an addition to the companies' plant at Rock Island, Quebec, to consist of a three-storey building, 180 x 60 feet, of concrete and brick.

The growth of Butterfield & Co. since its acquisition by the Union Twist Co. has been nothing short of phenomenal; the working force and floor space having been quadrupled in the last four years.

SHOULD CUT DOWN NUMBER OF LINES

Too Many Varieties of Steel Interferes With the Operation of the Rolling Plant

Leaders in various lines of industry are considering the question of standardization to a greater extent than formerly. In the last issue of "Financal Post" a number of instances were cited.

C. W. Sherman, president of Dominion Foundries & Steel, Ltd., touches on a different phase of Canadian industry, but the underlying conditions are practically the same. He points out that the reduction of the variety of products in Canada would be most desirable, due to the fact that the volume of business in this country is less than 10 per cent. of the American volume and the variety of demands just about as great as in the States. He proceeds as follows:

"Up to the present time we have only written and suggested various lines to our customers, and I mention the following: Take the one item of frame steel for automobiles—three thicknesses, light, medium and heavy, should cover the entire requirements of all the companies in Canada. On the other hand, we receive orders for at least twenty different thicknesses, varying in gauge from 100 to 200 thousandths of an inch. This greatly upsets our operation of rolling, shearing and shipping. This same condition also applies to other thin-shaped flat steel for miscellaneous plate work, agricultural work and deep drawing work.

"For Canadian consumption we would recommend that sheets be limited to four gauges—14, 18, 22 and 28, and that light plate steel up to quarter-inch be limited to six gauges—.095, .125, .150, .200 and .225. It can readily be seen that this would greatly facilitate manufacturing, carrying in stock and delivering flat steels."

ENGINEER HAS A DUTY TO PUBLIC

Calvert Townley Pointed This Out at Meeting of the A. I. E. E.

FOLLOWING the annual meeting for the election of officers and an informal dinner, Calvert Townley, president of the American Institute of Electrical Engineers, spoke before the Toronto section in the Engineers' Club on Friday last.

While much of his address was necessarily devoted to institute affairs, the speaker dealt at considerable length with the relations of the engineers to the public and the need for his taking an active part in affairs of the present moment. The engineer had always had an enviable reputation for truthfulness and fair dealing and was looked upon by the public as one whose opinions were worth listening to.

Modern civilization had been practically founded upon the work of the engineer and his guidance would be equally necessary in the present period of readjustment.

Speaking of institute affairs, Mr. Townley stated that a flourishing condition prevails, the membership was showing a healthy growth, the journal in its new form has proved to be an unqualified success and many letters of commendation had been received by the executive.

The following officers were elected for the ensuing year: Chairman, Frank Richard Ewart, Ewart, Jacob & Ryan; secretary, Perry A. Borden, Hydro-Elec. Power Commission; members of executive committee, O. V. Anderson, Tor. and Niagara Power Co.; L. B. Chubbuck, Can. Westinghouse Co.; W. P. Dobson, Hydro-Elec. Power Com.; S. E. M. Henderson, Can. Gen. Elec. Co.; George D. Leacock, Moloney Elec. Co. of Canada; Walter F. Wright, Eugene F. Phillips Elec. Works.

EXTENSIONS MADE BY LINK-BELT CO.

Policy of Expansion Has Been Announced to Affect Several of the Plants

Increased demands for their products have compelled the Link-Belt Company, whose general offices are in Chicago, to carry out an extensive program of expansion at their works in Chicago, Philadelphia, Indianapolis, Seattle and Toronto, Canada.

New manufacturing facilities have been added to the several plants, and the personnel of both factories and sales offices has been increased.

Two new furnaces—the seventh and eighth—have been added to the great chain works at Indianapolis in the last few months.

Announcement of the purchase by the Link-Belt Company of the Fairmount Foundry, at Philadelphia, was made a


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We make Kwik-Kut Power Hack Saw Machines which use practically the full cutting edge of the Hack Saw Blade at each stroke; Metal Cutting Band Saw Machines for general shop work, cutting all classes of metal up to 12 x 14 inches.
Your requirements for Metal Cutting Circular Saws can be supplied promptly and we solicit a trial of our "AAA" Non-Breakable and Power Hack Saw Blades and Frames.
"A Better Saw for Every Use"
E. C. Atkins & Co.
Established 1857
"The Sterling Quality Saw People"
Factory: HAMILTON, ONT
Branch: VANCOUVER, B C.
E.C.ATKINS & CO.
THE FINEST ON EARTH

few days ago by Mr. Charles Piez, president of the Link-Belt Company.

This deal involved several hundred thousand dollars. The foundry will be used as an adjunct to the Eastern works at Philadelphia, supplying this plant with grey iron castings.

A new administration building is under construction at the Philadelphia works, and plans are being made to erect another such building at the Chicago works, to make room for enlarged engineering, sales, drafting and clerical staffs.

The shops at Toronto and Seattle are being expanded to take care of the steadily growing business in those regions. In the Chicago works foundry a conveying system is being installed to speed up output. A new warehouse is under construction at Seattle. The Toronto shops and offices will shortly occupy new quarters there.

Mr. A. C. Johnston, formerly Chief Engineer of the Chicago works, has been elected vice-president of the Link-Belt Company, and resident general manager of the Chicago works. He succeeded Mr. Prentiss L. Coonley, who resigned to devote his time to the presidency of the Isko Manufacturing Company.

LESSONS ON THE ABC OF GOOD WELDING

(Continued from page 420)

that for such emergencies the manufacturer of your torch can provide you with a removable water-cooled tip and connections which can be attached to your welding torch. It is very essential that such tips and connections be removable, as their added weight would seriously impair the usefulness of the torch for ordinary work on which their use is not required.

If such water-cooled tip and connections cannot be secured, the head and tip of the torch can be cooled occasionally by plunging them in water. This is violent treatment, but any well-built torch must stand it. By using a well-filled pail, all the parts may be immersed except the flame and bare end of the tip, which are left protruding above the surface. This saves the time that would otherwise be spent in extinguishing, relighting and adjusting the flame

(NOTE.—This article is the second half of the first of twenty lessons used by the author for the instruction of students in the art of welding. Other lessons will follow in regular sequence.)

The Carlyle Johnson Machine Co., Manchester, Conn., have issued a very attractive booklet on their friction clutches as applied to machine building. Close to 50 different and varied applications are illustrated and described, each of particular interest to the machine tool builder.

A copy of this book will be sent upon request to the above-mentioned firm, and as this is something of particular value to the purchasing agent, owner, and designer, alike, we feel sure many will avail themselves of this opportunity.

TRADE GOSSIP

Montreal.—Mr. Thomas Robb, secretary of the Shipping Federation, will not be able to accept the appointment to represent the Canadian Shipping interests at the Seamen's Conference, to be held in Nenoa, Italy, in June next. The name of Mr. A. W. Wright of Kingston has been accepted instead.

To Take up Civil Engineering—Due to recent amalgamation placing them in a very favorable position for carrying out large contracts, Messrs. Armstrong Whitworth of Canada have decided to enter the public works contracting field. The new development will be under the control of Mr. Robert H. Mackenzie.

Action for Shell Commission—Mr. R. R. Carr-Harris, general contractor of Toronto, is suing the General Electric Company for $658.80, which he claims to be due for obtaining contracts for the latter, and in accounting. The contracts were in connection with munition supplies for the Allies. The General Electric Company states in their defence that the contracts were secured by Sir Frederick Nicholls, and not by the plaintiff.

Merger Interests Meet—The British syndicate that is interested in the huge steel and coal merger in Canada held a meeting recently to hear the report of Sir Newton Moore, who had just returned from a tour of inspection in that country. The report presented by him and Mr. Talbot, a technical steel expert, was well received, and the representatives of the different interests present were fully satisfied of the ultimate success of the amalgamation.

Big Power Contract Let—The Nova Scotia Power Commission at a recent meeting let the contracts for the St. Margarets' Bay Power Development. The contract for the four electric generators went to the General Electric Co., and will be built in their shops at Peterborough. The Pacific Coast Pipe Co. of Vancouver were awarded contracts for wood stave pipe 6 feet and 10 feet diameter. The general construction contract, including the building of power houses, dams and intakes, were awarded to D. G. Loomis & Sons, Montreal.

TENDERS

Tenders are being called for four concrete bridges , for the County of Wellington. Tenders must be in by May 4th. Full particulars can be obtained from James Beattie, County Clerk, Fergus, or from Mr. A. W. Connor, 34 Victoria street, Toronto.

Tenders are being called for, and will be received until May 5th for the Sarnia Collegiate and Technical School. Tenders for reinforced concrete, brick work, flooring, etc., must be submitted to S. B. Coon & Son, Toronto, from whom plans and specifications can be obtained.

The Vancouver Harbor Commissioners are calling for tenders for the filling and dredging for the Harbor Commissioners' new pier at Burrard Inlet. Plans and specifications can be obtained at the office of the Harbor Commission, 712 Pender Street, W., Vancouver, B. C., or at the office of Mr. A. D. Swan, C. E. 10 Philips Place, Montreal, P. Q.

INTERESTING CATALOGUE

The Albert Herbert Ltd., Coventry, England, who have started a Canadian branch at 31 Yonge St., Toronto, have forwarded to this office a very interesting catalogue on "The Turret Lathe and Its Work."

This book describes what is known as their combination turret lathe, and illustrate various set-ups which contain valuable hints in turret lathe practice. There are about 60 illustrations of work performed on this type of machine and all worthy of attention.

The Capstan style lathe is next discussed and this style machine is also profusely illustrated and set-ups explained in detail.

The Automatic trimming machine is next in order. This machine is somewhat similar to the P. and J. type and again the photographs of all set-ups are exceedingly interesting.

Last comes the Hexagon turret lathe, and the class of work performed on this machine is well worthy of attention.

This catalogue, or book as we prefer to call it, should be of decided interest to anyone contemplating the purchasing of new equipment and a copy can be procured upon request.

PIG IRON REVIEW

The loss of iron due to strike is estimated at 500,000 tons. The situation is clearing in various quarters, and shipments are going forward more freely. This is the case in the Eastern Pennsylvania district, according to despatches from Philadelphia. On the other hand, shortage of coke in the same district has caused several more furnaces to be banked. The business done during the week in this district amounted to a fair volume. Foundry's iron is on a base of $45 for No. 2 plain Eastern Penn furnace. There has been a fair amount of Bessemer sold also. The Chicago market presents no features of interest. The railroad situation is still bad in that district, and stacks are operating on a narrow fuel margin. Southern iron is quoted at $42 Birmngham, and northern ron is $43 Chicago. The strike of the railroad switchmen came at a bad time for the iron trade in the Pittsburg district which was in a fair way of overcoming the acute shortage. It is estimated that 50 per cent. of the production in ths district was lost during the past week. It is expected that a strong demand for prompt iron will be one of the results, and already a strong tone is developing. 10,000 tons of basic was placed at $43 valley furnace. No. 2 foundry is quoted at $44 but only a few small sales have been made at that figure. One of the developments of the strike situation is the movement of resale iron in New England, and the fancy prices obtained for this material. No. 2 X has been sold under these conditions at $65, while the lowest price is $60. The embargo still holds on all New England railroads, and no iron is coming in from outside. New York reports very little iron coming in, though a good business was done during the past week.

WHEN WRITING TO ADVERTISERS KINDLY MENTION NAME OF THIS PAPER

CANADIAN MACHINERY AND MANUFACTURING NEWS

429

Vol. XIII, No. 19. May 6, 1920

Keeping Tab on Parts in an Agricultural Factory

How Would You Like to Keep Track of Over 10,000 Different Parts? Here is the Method Adopted in the Plant of the International Harvester Company, of Hamilton, Canada

By J. H. MOORE, Associate Editor Canadian Machinery

HAVE you ever spent a day on a farm? Of course you have, for there are very few people who have not sojourned at least one day of their life in the country. The next question, however, is not so easy to answer. You, no doubt, have seen a binder, drill, mower, or thresher at work, but have you ever stopped to consider the intricacy of these agricultural machines, or have you been content to merely exclaim as they accomplished their work, "My—that's wonderful!"

As a general rule, people never consider this phase of the situation, but in the article to follow, we will prove the exception to the rule, taking you into the plant of the International Harvester Co., of Hamilton, Canada, explaining their method of keeping tab on the innumerable number of parts which go to make up their various products.

Any attempt at mentioning the actual number of parts used on their machines, would only be confusing, but futile, so taking it for granted that readers appreciate the fact that these agricultural implements or machines are of a very complex nature, we will proceed to describe the various step of recording new parts, changes to old parts, instructions regarding setting up, etc., etc.

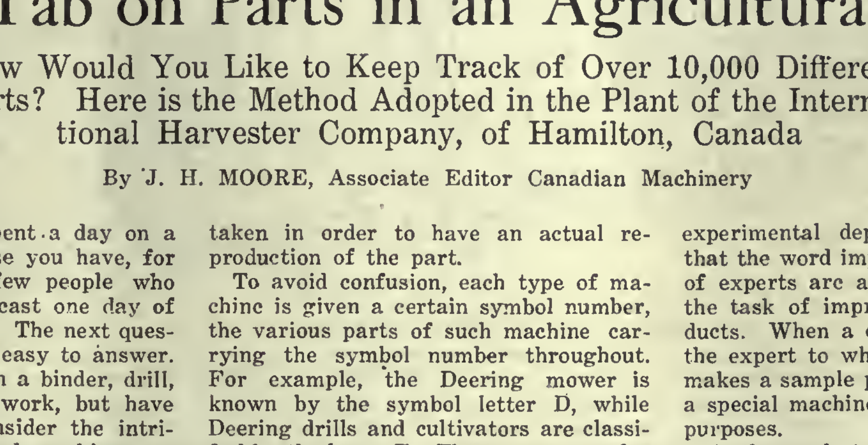


FIG. 3—ILLUSTRATING THE IDEA OF LINE DRAWING REPRODUCTION.

One can readily understand that a progressive concern, such as the firm we speak of, is at all times endeavoring to still further improve their product, thereby necessitating changes to former parts. These changes would cause confusion in the records were not some card system, symbol numbers, etc., adopted. Photographic records are also taken in order to have an actual reproduction of the part.

To avoid confusion, each type of machine is given a certain symbol number, the various parts of such machine carrying the symbol number throughout. For example, the Deering mower is known by the symbol letter D, while Deering drills and cultivators are classified by the letter F. These two examples will suffice to explain the system.

It is the policy of the company to issue part books, instruction setting up books, etc., containing line drawings, showing the various parts, either separate, or in assemhly. In this way the photographs are used, not only for record purposes, but illustrative work as well. These books are of a standard type, 6 in. x 9 in., which allows the taking of a standard size of photograph. The advantage of thus standardizing the photography process is so self-apparent that no comment is necessary.

For illustrative purposes we will suppose a batch of new parts (or samples as they are called) have reached the stage when they are completed, and passed on as o.k. by the experimental department.

It might be well to mention that this experimental department is everything that the word implies, for a trained staff of experts are at all times engaged on the task of improving the various products. When a change is contemplated, the expert to whom the task is allotted makes a sample piece, using this part on a special machine kept for experimental purposes.

A thorough test is made before the idea is finally adopted (or rejected as the case may be) and the heads of the different departments are called in to give their opinion on the advisability of the change.

It is only after all the pros and cons of the situation have been carefully considered that a decision is given to adopt the new part. Immediately this point is settled, a photograph of the part (together with others which have received a similar o.k.) is taken in the following manner:

The Photographic Process

All photographs are taken on an 8 in. x 10 in. plate. Every arrangement of samples is made on a special board, 5 ft. long by 4 ft. wide. This board is painted white. The picture is always taken the long way of the board. The photographic system is standardized in this way to attain a definite purpose, for as explained before, all instruction books, etc., are of a standard size. By photographing the samples in this way, it is found, when reproducing for illustrative purposes, that by a certain scale of reduction, two of these boards can be shown on one page of the part or instruction book.

Another point which is watched very carefully is that every part shown on the board has sufficient space around it to ensure the cutting out of that part if necessary, without interfering with the other parts shown.

To illustrate how one of these boards appears after being photographed, let us look at Fig. 1. It will be necessary to refer to this photo quite often, so we would suggest that readers give it their careful consideration. First, we call attention to the fact that in the upper left hand corner of the plate is marked, H 1306, Scale 1/6, 1-29-1916V.

This style of data is given on every plate in order that a definite record may be kept on every negative in the plant. H 1306 is, of course, the plate number, and an envelope is numbered in similar manner to hold this plate. Each negative has its own envelope, and these are filed in special cabinets, being numbered consecutively. The next notation on the plate, namely, 1/6, signifies that the parts are shown 1/6 their actual size. A two-foot rule is placed on the board to show the proportion of the various parts.

The previous method was that of painting in the letters. This was not only a slow process, but was never standard, or neat. Here is a tip well worth adopting for many other lines of work.

The matter of arranging the various parts on the board depends entirely upon the shape and size of the part. In as

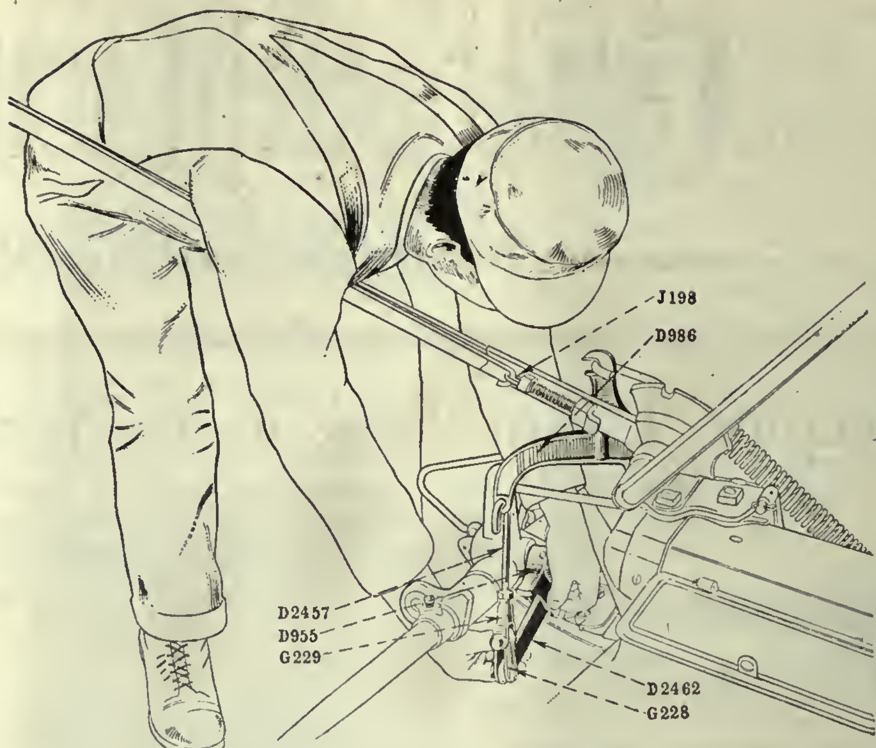


FIG. 4—A GOOD EXAMPLE OF THE INSTRUCTION POSSIBLE BY MEANS OF A LINE DRAWING.

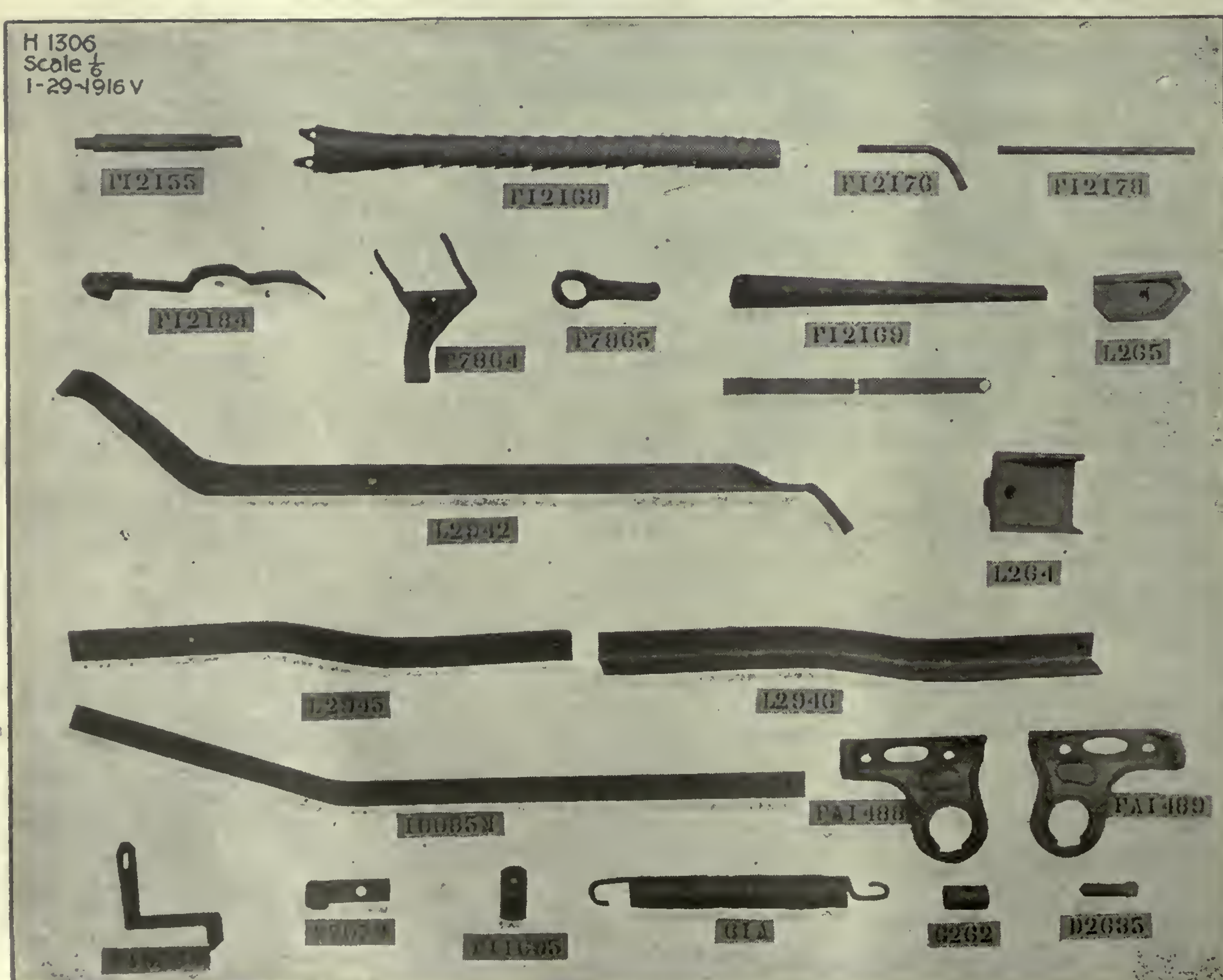


FIG. 1—ILLUSTRATING THE STYLE OF PHOTOGRAPHS MADE FOR REFERENCE AND FILE PURPOSES.

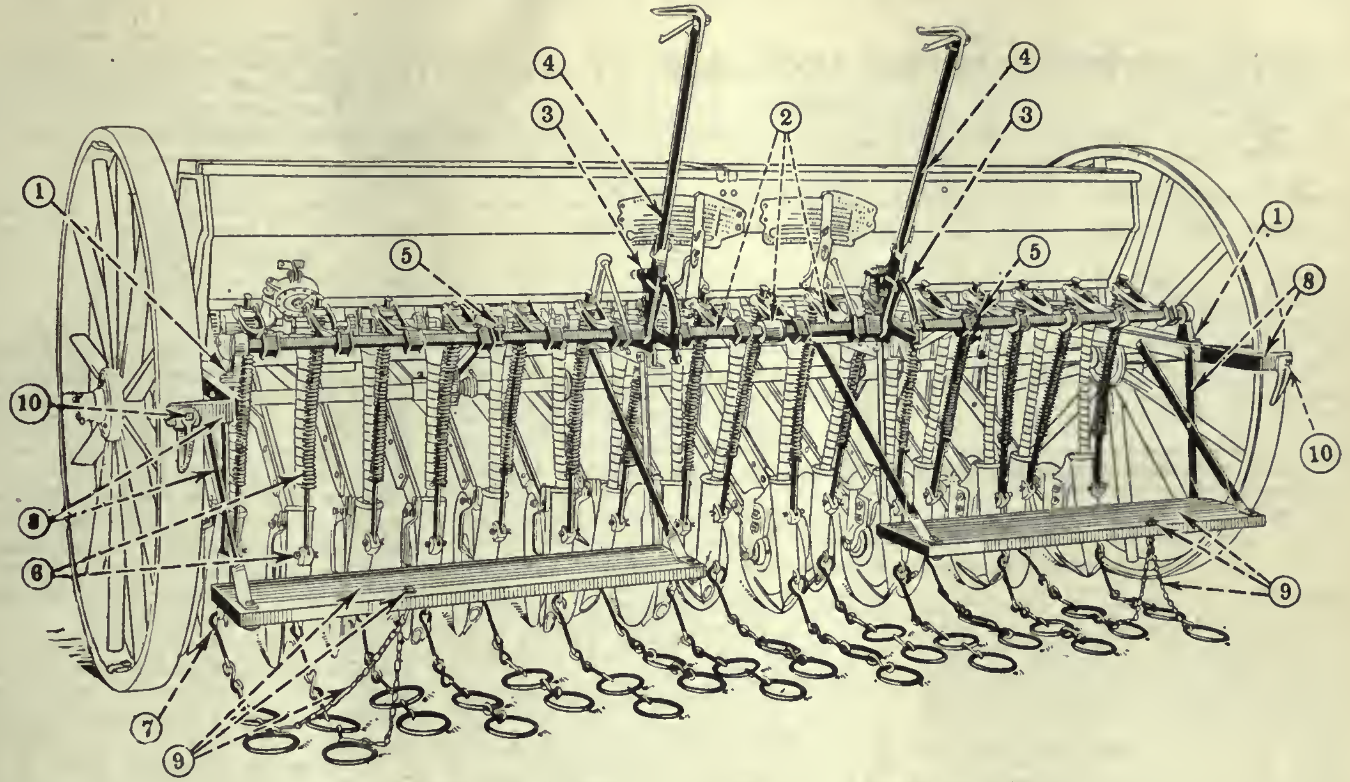


FIG. 3—A LINE DRAWING ASSEMBLY OF A DEERING 16 MARKER SHOE DRILL.

far as possible, they are placed consecutively, but this is not always convenient, as the illustration depicted clearly shows.

One point watched carefully is this, that every part must be so arranged that it can be cut out without disturbing any of the others. It is absolutely essential that this be done, as it often occurs that a certain piece is used on as many as twenty-five different machines. By placing the parts on the board in a separated manner, one photograph is all that is necessary of any part, as the line drawing which is later made from the photo is distinct in itself and can be used in the making up of the various part books, etc.

Once a photograph is taken, and a cut, or zinc made from that photo, it is interchangeable for any other book.

The Line Drawing Method

The next step following the development of negative and printing of photograph is the making of two blueprints from the same plate. It is, of course, impossible to show the blueprint in this article, but readers can well imagine its appearance. One of these prints is put on a board file for office reference purposes, while the other, together with the photographic print already made, is forwarded to the engravers. It might be mentioned that all prints are made on black and white contact paper, ferrotyped.

The engraver now outlines, in line drawing fashion, the various pieces shown on the blueprint of the negative, using the photograph for reference purposes whenever necessary. In this way he is sure of correctly portraying the contour of each piece, as between the photo, and the blueprint, he cannot—without being absolutely careless—make a mistake.

To illustrate how one of these boards looks after the engraver is through, we refer you to Fig. 2. You will note that the pieces FA 1488 and FA 1489 are line drawings made from the same pieces shown in the photograph at Fig. 1. The

Memo No. 4030 EXPERIMENTAL DEPARTMENT D4377. 2½m.-12-19.
SAMPLE AND PATTERN MEMORANDUM
Hamilton Works Jan. 17th. 1920. 1929

MACHINE 1920 - DEERING HAY RAKES

Mr. Mr. P. Rigby,

Planning Dept.

Please note New Sample delivered to your Department to-day for

CAT. NO.	NAME	MATERIAL	PATTERN EQUIPMENT
RA317 -	Hand Lever Socket	- Mall.-	

A portion of the Boss around the rear adjustment hole on the Lever side has been cut away slightly. Also 1/16" of metal has been added outside each of the two square holes for Carriage Bolts which secure this part to Rake Head.

Is in accordance with Decision #2463-D-

Use up Castings on hand.

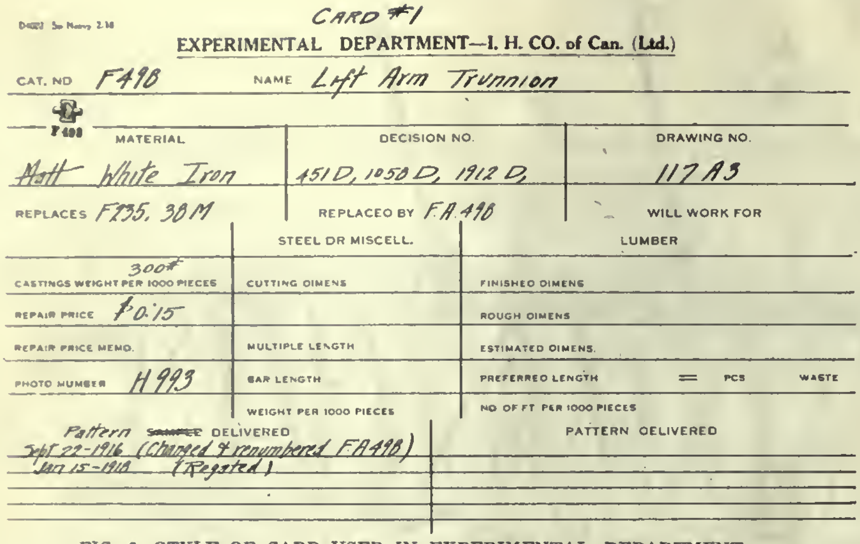
New sample was made here and replaces sample previously in factory which has been destroyed.

EXPERIMENTAL DEPARTMENT
BY

Copy to Messrs:
Armour Hill
Dodds Knapp
Forster Linklater
Gleason Muldoon
Goodram Mathieson
Gayfer Slater
Hobbard Wiggio(2)
Honeyford Raiser
Heory

Received Patterns .... Foundry Foreman
Delivered Trial Castings to Inspecting Dept .... Foundry Foreman
Received Trial Castings from Foundry to-day ....
Checked Castings with following results ....
....
....
....
.... Inspection Foreman.

FIG. 5—TYPE OF MEMO. FORM USED IN PLACING NEW SAMPLE IN THE FACTORY.



CARD #1

EXPERIMENTAL DEPARTMENT—I. H. CO. of Can. (Ltd.)

CAT. NO F498 NAME Lift Arm Trunnion

F498

MATERIAL	DECISION NO.	DRAWING NO.
Matt White Iron	451 D, 1050 D, 1912 D,	117 A3
REPLACES F235, 38 M	REPLACED BY F.A. 498	WILL WORK FOR

	STEEL OR MISCELL.	LUMBER
CASTINGS WEIGHT PER 1000 PIECES 300#	CUTTING DIMENS	FINISHED DIMENS
REPAIR PRICE $0.15		ROUGH DIMENS
REPAIR PRICE MEMO.	MULTIPLE LENGTH	ESTIMATED DIMENS.
PHOTO NUMBER H993	BAR LENGTH	PREFERRED LENGTH = PCS WASTE
	WEIGHT PER 1000 PIECES	NO OF FT PER 1000 PIECES

Pattern ~~SAMPLE~~ DELIVERED	PATTERN DELIVERED
Sept 22-1916 (Changed & renumbered FA498)	
Jan 15-1918 (Regsted)	

FIG. 6—STYLE OF CARD USED IN EXPERIMENTAL DEPARTMENT.

other pieces illustrated do not show in Fig. 1, but this feature is not a detriment, but rather a help, for it brings out the advantage of arranging each piece as a separate zinc by itself. Had this been the case, it would have been impossible to arrange the board as shown.

To further illustrate how this line drawing principle can be used to good advantage, we show Figs. 3 and 4:

Fig. 3 depicts an assembly of a Deering shoe drill, 16 marker, and gives the agent, or customer, a splendid idea of its arrangement of parts.

At Fig. 4, we see a drawing of a very different nature. In this case, the illustration takes the form of a lesson in the proper method of connecting lifting lever bell crank to swivel hinge bell crank on a Deering mower. These are only two examples, but the advantage of this method of illustrating parts is so self-apparent, that we pass on to the record system as adopted by the experimental office.

The Office Records

Having already explained how blueprints of the various negatives are kept on proper board files, there is no need to touch on this again, so we will start at the point where a new sample is issued from the experimental department.

At Fig. 5, we illustrate the type of memo form used for this purpose. It will be noticed that the memo number is placed in the upper left hand corner, in this case the number is 4080. These memos are, of course, filed consecutively. Next comes the date, also the type and year of the machine on which the part is used. This memo is sent to what is known as the planning department.

Now comes the catalogue number, the name of the piece, the material, and a detailed description of the piece. In the case shown the new sample is superseding an old one, and all the changes are explained, also the decision number is given, so that the result of the decision can be looked up if desired.

Copies of this memo are forwarded to the names listed below (see memo), these names being the various departmental heads throughout the plant. By this system every department in the entire plant is acquainted with the fact of the new sample being issued, and all particulars pertaining thereto.

The experimental department also keeps a card system on every part, these cards which are showing every particular. Take for example the card illustrated at Figs. 6 and 7. Here we show both sides of the card. It will be noticed that the catalogue number, name of part, line drawing of part, material, decision numbers, and drawing number are all given. The parts which the new piece replaces is also stated, and should it be later replaced itself, it is stated on the card, as is shown by FA 498, on the present card under discussion. The weight of 1,000 pieces, etc., are all given, and we cannot do better than suggest that readers study this card carefully, for there are many headings which we have not filled in, and that are worthy of note.

On the reverse side of the card is shown some of the machines on which the same piece is used. It will be noticed that this card is marked No. 1 in the upper right hand corner, the reason for this being that quite often a piece is used on so many other machines that more than one card is necessary to complete the record.

To illustrate how these cards can be used in conjunction with the finding of any certain part on a blueprint, let us concoct a theoretical case. We will suppose that we are in charge of the filing system and that someone comes in, asking for part No. F 498.

We immediately go to our filing cabinet, which is arranged in drawer form, and in the drawer with the proper tab on its front, we soon find the card as illustrated at Fig. 6.

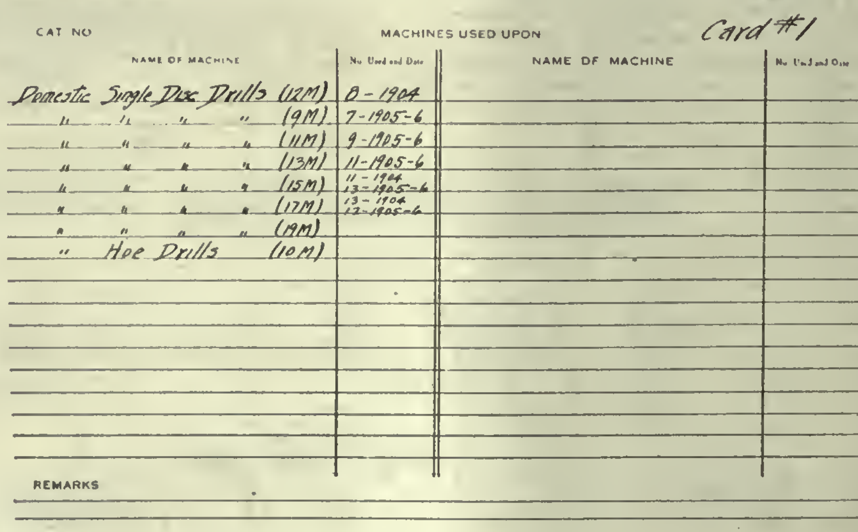
"That piece is now replaced by FA 498." we tell our friend who is after particulars. We next go over to the board files, and in consecutive order we find the proper blueprint showing the piece desired. We can, if we desire, go right to the proper negative, as the photo number is also shown on the card. We can also go direct from this card to the drawer containing the mechanical drawing of the part, as this is also given on the card. In other words, the card serves more than one purpose.

When a card, as shown, is filled out completely, it not only records what piece replaces the original part, but it also depicts how long a period each piece was used, giving the year, model, etc.

The Cross Index Plan

To ensure against any possible error, a cross index system is arranged in the following manner: A complete list of parts, with full description, is placed in loose leaf book form. Should a piece become obsolete, it is marked out, by writing the word "Obsolete" across the entry, the reason why it is discarded and so on. Every detail is stated in this record, in order to be sure that a close tab is kept on the various parts going through the plant.

When we estimate that roughly some 10,000 parts are passing through this plant at the present time, readers can form a fair idea of the magnitude of the task. While we have explained this system in a matter of fact way, the method in its present state has only been reached after years of careful revision and improvement, so that readers in general will be wise to study carefully this method of record keeping in its entirety.



CAT NO MACHINES USED UPON Card #1

NAME OF MACHINE	No. Used and Date	NAME OF MACHINE	No. Used and Date
Domestic Single Disc Drills (12M)	8-1904		
" " " " (9M)	7-1905-6		
" " " " (11M)	9-1905-6		
" " " " (13M)	11-1905-6		
" " " " (15M)	11-1904 13-1905-6		
" " " " (17M)	13-1904 13-1905-6		
" " " " (19M)			
" Hoe Drills (10M)			

REMARKS

REVERSE SIDE OF THE CARD SHOWN AT FIG. 6.

Are You Acquainted With Art of Roll Turning?

The Second and Last Portion on This Interesting Subject—Further Details Are Given as to the Duties of the Roll Turner

By W. S. Standiford

IT is a well-known fact that all tools must be harded than the metal that they are cutting. When they are nearly matched for hardness, the tool has to be ground often, thus delaying the work and adding to the expense. High-speed metal in spite of its high cost saves money in the long run for roughing work as a very little grinding is required. A few rubs of the tool on an oil-stone puts the cutting edge in good shape. Some employers seem to think that any grade of ordinary tool steel is good enough for roll-turning and buy cheap steel; which does for working iron or steel rolls but necessitates frequent regrinding. The hardest metal the roll turner has to turn is chilled cast iron and also chilled rolls made out of an alloy of chilled iron and manganese steel, and nowhere does poor steel show to such a disadvantage as in turning these classes of rolls. When used for finishing a groove, the edge breaks out and makes fine hair-lines upon the work. It does not produce true circular work on account of its being unable to keep a sharp cutting edge, it being necessary to use very sharp tools in finishing the grooves. There are two stages in roll turning, one called "turning" and the other "dressing" Turning is the making of new rolls out of the rough castings as they are received from the foundry; new ones do not have to be made every day in the ordinary sized mill, although in large ones, they always keep some journeymen on new work.

Other Interesting Facts

Roll foundries turn out rolls finished all ready to be put into the mill, as well as castings in the rough, they giving employment to quite a number of men. After the rolls have been awhile in the mill, the grooves become rough and worn by the constant friction of the metal rolled and need to be sent to the lathe to be put in shape; this is called "dressing." The amount of metal removed in dressing varies greatly, depending chiefly upon the kind of metal in the roll, length of time it has been used in the mill and the character of the metal rolled. On chilled rolls the amount is generally about 1-32 of an inch by the calipers, or 1-64 inch on each side of the roll. This removes the rough pin-holes caused by rolling friction and provides a bright surface. By frequent dressing, the rolls get smaller until they are too small for the mill; they then go to the "scrap-pile" and are replaced by new ones. As a general rule, they earn thousands of dollars for the company before being consigned to the scrap heap, although, it does occasionally happen that a new roll breaks in two, or has a neck twisted off after a few hours of use. The rolls that are mostly in use by mills are sand, chilled, chilled-alloy, semi-steel and steel rolls. Each of these kinds has its good qualities and its particular use for certain purposes. Sand rolls are made by pouring the hot metal into a mold made out of sand, the best ones being made of gray-mottled iron; this is a material that gives most excellent results when used for making bar iron rolls. Chilled iron rolls are made by ing in a metal mold. When the molten iron comes into contact with the cold sides, it cools quickly on its surfaces to a depth of 1½ to 4 inches and over as desired, it all depending upon the size of the rolls and what they are to make. The usual practice of foundries is to leave the centre soft and tough so as to prevent the necks being twisted off or roll breakage in cold weather. The characteristics of this class of rolls is their extreme hardness, a file making no impression upon them. But the best ones are made just so hard that a file or a first-class centre punch will barely make a mark. This gives a degree of toughness to the dense brittle material, and helps to some extent to prevent the collars of such rolls from breaking out so readily, if a sliver on a bar should get between the collars during rolling. These rolls are used, to a great extent, for finishing work, the grooves keeping their shape quite a long while before they require dressing. In putting them in the mill, care must be taken that they are not too roughly handled or dropped, as pieces of the grooves are liable to be broken out, thus ruining it for future use.

The chilled-alloy rolls are generally tougher than the chilled ones, but some of them are liable to have hidden cracks in their interior, which come to light when turning deep grooves. Semi-steel rolls have a closer grain when turned than the ordinary cast iron soft rolls, they being a good wearing material which works well in turning in the lathe. Steel rolls are used where great toughness with a moderate amount of hardness is desired; they are for roughing, and also for shapes having delicate points, such as "finger-bars," etc. They should be made of steel containing very small quantities of sulphur and phosphorus. The following is the analysis of a pair of open-hearth steel rolls that comes very near the ideal of what such rolls should be. In actual work, they stood the battering action of heavy manganese steel ingots of all degrees of hardness for nearly sixteen months, and were then relegated to the scrap heap because they became too small in diameter for the mill.

Carbon combined	.49
Silicon	.211
Phosphorus	.041
Sulphur	.036
Manganese	.68

The mill should be so constructed and equipped with labor-saving machinery (and also with powerful engines or electric drive) that there need be very little re-handling of coal, etc. Modern American mills and also Canadian ones are splendid examples of this, they being operated with very few men and producing a large tonnage at a minimum of expense. The up-to-date mill has a separate shop for its roll turners; well-lighted and so arranged that it can be warm-

A HEAVY GEARED TYPE OF ROLL TURNING LATHE ed to a comfortable temperature in the winter.

The Life of the Turner

Anyone passing through a roll shop and observing a roll turner at work, naturally concludes that he has "a snap"; nothing could be further from the truth, as he has a lot to contend with. Iron, steel and copper work differently in various mills. This is due to the difference in engine power to drive the rolls and other factors such as the manner in which the metal is heated for making the finished bars. Rolls that work well in one mill, will not do so in another, the differences in the motive power making it necessary to ease the drafts of the roll passes in order to make them pull the metal through. Uneven heating, with cold spots on the metal, alters the working of it in the rolls, the roller in most cases, putting the blame on the roll turner for defective work, when as a matter of fact, it is the heater's fault. The roll turner has to be continually on his guard when he works in various mills throughout the country. However, the advantages that accrue from working in different mills are not to be gainsaid, as each one turns out a different line of product, and also has the roll pass layout put in rolls at different angles for making the same lines of goods, the result being that the roll turner who works in various mills gets skilled in every variety in work, and thus renders himself fit to take a foreman's position, as the latter must be filled by a man skilled in designing and turning all kinds of work, new inventions of iron and steel sections being made continually. The roll turner should stay a year at each place in order to get the benefits of experience, and not move to another mill every two weeks like some roll turners do.

Many journeymen stay at one mill all their lives, thus becoming specialists in their line of work, but rising no higher. This accounts for the fact that some men are able to do only sheet work and others wire rod work, etc.; travel also broadens a man, as he is bound to come into contact with people of different dispositions, and overcome many difficulties in roll turning, thus learning self-control.

It is equally certain that he will get into some mills of an antediluvian pattern, if he gets his situations by advertising, which is the usual method, it being advisable to not let go one position until another is secured. Considering the bad roll lathes that some of these mills contain, it is surprising that the roll turner can turn out anything like decent work at all. Some lathes are so worn in gearing and bearings that they can be heard a square away. The housings are so broken and patched that they do not stay long in line with the bed, but twist and spring one way or another, when a decent cut is being taken. Add to the above, a roof that lets the water in onto the roll and lathe when it rains, and a condition is met with that taxes the patience and moral fibre of the roll turner. Some firms put the lathes in the mill, near the roughing rolls; the result being that the workman stands a first-class chance of having an eye destroyed by flashes of hot metal from the rolls. Other parties have the happy (?) faculty of placing the roll lathe in the darkest part of the mill, and then generously allowing their roll turner to use a couple of small miners' lamps, each holding about two ounces of oil. These supply barely enough light to allow the workman to see where the point of the tool is going. There being a draft of air in most mills, also allows the roll turner to inhale a lot of the smoke from the lamps. In addition to all this, the journeyman generally freezes in winter and roasts in summer. Another Eastern roll foundry, which is now defunct, had a yellow clay floor for the worker to stand on while turning rolls, the clay being finely pulverized by the constant putting of finished rolls on it caused a fine yellow dust to settle over the lathe and workman, the result being that when it was time to go home, every man had his clothes colored yellow. It is needless to say that the writer did not stay long at that shop, as it was too uncomfortable.

In some old-fashioned mills, equally strange methods are used to put large rolls into the lathes, one of the most curious of these being the use of a large ship's capstan. This was situated at about 50 feet from the machine. Above the latter, fastened to an I-beam, placed at a right angle to the lathe and extending 6 feet in front of it, was a traveler fitted with two ordinary ship's blocks. Located on the floor, and secured firmly to a post, was another block. A two-inch rope extended from the capstan along the ground to a sheave of the block on the floor, and thence to the blocks fastened to the traveler over the lathe. The lower block on the traveler contained a large hook on the end. The method of procedure was as follows: The roll was placed by means of crowbars in front of the lathe; a chain with a ring in the middle and two hooks, one on each end, was attached, the ends of the chains being passed around the wobblers and the hooks run through the chains, thus holding the roll securely. The hook on the overhead block was run through the ring, and capstan manned by eight negroes, the roll being hoisted higher than needed. The traveler block holding the roll was pushed in until it was over the lathe, and the roll then lowered in place.

This method of doing business was exceedingly dangerous, as the rope was old and had many of its strands unravelled. Had the rope broken, it is most

THE NUMBER OF MEN IN THIS PICTURE GIVES READERS SOME IDEA OF THE LARGE SIZE OF THE LATHE.

likely that some of the men working the capstan, and also those around the lathe, would have been killed or hurt. Another mill had its rolls put into the lathe by means of an inclined plane; they being rolled up it by workmen with crowbars, while one man kept placing wooden wedges back of the rolls, to hold it while the others got another hold with the crowbars. When it arrived upon the lathe rest it was rolled into position in the machine. One firm had a method of putting large rolls weighing 6,000 pounds into the lathe by means of jacks and a cribbage of railroad ties. This was accomplished by raising the roll by the jacks, then placing the ties under; letting the jacks down and taking a fresh hold and putting more ties under the roll. This performance was repeated until the roll was at the requisite height; it then being rolled into the machine. Nearly three hours were wasted by this process. It is most likely that such crude ways of doing business and wasting time will be done away with in the future, even in small mills. A good, first-class electric or a hand-driven crane would use up only a few minutes in doing work of this kind. A rolling mill should be erected where ample shipping facilities can be had, both by rail and water. It is also advisable in locating new mills to build them where a free supply of water can be obtained to cool the rolls and also for condensing purposes. The writer knows of one small mill that has to pay a city for all the water that it uses, the result being that their bill for water supplied is over $3,000 per month. This adds considerably to the operating expenses and should be avoided.

Another thing that ought not be overlooked is the fact that steel works, etc., should not be built in a town of less than 10,000 inhabitants on account of the difficulty of keeping the skilled men, as the latter generally do not care to stay in small country towns where there are very few places of recreation. This is the reason why many employers have such difficulty in getting skilled men to remain long in towns containing a few people. A married man, non-resident, must send his wife money for her living expenses, until he can save up enough money to bring his family to their new location. If the married man owns a home, he generally stays in one place. If employers wish to retain their men, they should encourage their workmen to buy homes. The company's idea in locating mills or factories in small towns, is due to the fact that the taxes are low; but the means of retaining their working force should also be given consideration.

The influence that new invention and improvements exert upon the roll turning trade is most important, some of the shapes that the inventor creates calling for the utmost skill on the roll turners' part in designing rolls, in order that the section may be rolled. From the foregoing, it may readily be seen that the roll turner holds a most important position in regard to helping to add to the comforts that the civilized nations enjoy, his being a trade that will probably last until the end of the world.

CANADIAN ENGINEERING STANDARDS MAKING HEADWAY IN SOME LINES

A MEETING of the main committee of this Association was held at Ottawa on April 12th, Sir John Kennedy in the chair, when a number of items of interest were dealt with.

The general specification for steel railway bridges submitted to the Main Committee by the Sectional Committee on steel bridges and construction, was approved for publication. This specification, the essential provisions of which are fortunately in general agreement with the practice of the American Railway Engineering Association, is not drawn up with an intention of limiting the choice of the engineer as to type of bridge, but is so framed as to indicate definite methods of work for the designer, retailer and manufacturer, with a view of thus obtaining uniform results as regards strength and utility.

The specification, as now approved, is based on that published in draft form in 1918 by the Engineering Institute of Canada, and drawn up by a committee of that Institute under the chairmanship of Mr. P. B. Motley, engineer of bridges, Canadian Pacific Railway Company. The work of the C. E. S. A. upon it was undertaken at the request of the Engineering Institute of Canada.

It is announced that sub-committees have been appointed for the purpose of drafting general specifications for guidance in the purchase of wire rope, both for mining purposes and for dredging and steam shovel work. The former subcommittee is under the chairmanship of Mr. F. H. Sutherland, Inspector of Mines of Ontario, and the Chairman of the latter is Mr. K. M. Cameron, Department of Public Works, Ottawa.

A report from the Chairman of the sub-committee on Telegraph and Telephone Wire, Mr. W. J. Duckworth, of the Great North Western Telegraph Co., Toronto, stated that a specification for two standard grades of this material had been drafted and was now being considered and amended by the sub-committee.

Mr. J. G. Morrow, Steel Company of Canada, Hamilton, chairman of the Sectional Committee on Steel, reported that a Special Committee had commenced work with a view of co-ordinating the numerous specifications for material for carbon steel forgings now being worked to in Canada, and if possible, establishing the characteristics of a comparatively small number of grades of steel which could be used to fill those specifications.

It was decided to instruct a Special Committee, under the chairmanship of Mr. E. G. Burr, consulting engineer, Montreal, to proceed with an inquiry into the desirability and possibility of framing a Canadian National Electric Code. It was pointed out that such a document, so far as hazard to life is concerned, has been drawn up in the United States under the auspices of the Bureau of Standards, while fire hazard has been dealt with by the rules of the National Board of Fire Underwriters. The subcommittee is to consider the measures to be taken should it be thought advisable to draft a Canadian Code for covering these subjects for wide acceptance in the Dominion.

A communication was read from the Council of the Engineering Institute of Canada, requesting the Association to deal with a number of the specifications of the Institute, considering and revising them if thought necessary, as has already been done in the case of the specification for steel railway bridges. It was decided to take up first the Engineering Institute of Canada specifications for steel highway bridges and for cement, and to organize suitable committees to report upon them.

It was announced that the Air Board had approved of the Canadian Engineering Standards Association, through its Sectional Committee on Aircraft Parts, as the body through which Canada is to be represented on the International Aircraft Standards Commission. This action was welcomed by the committee, and it was pointed out that the approval of the Air Board gave official recognition to the work which has already been accomplished by Canadian representatives at meetings of the Commission.

The International Aircraft Standards Commission was organized in 1917, primarily as a war measure, with the object of obtaining, as far as may be, international agreement regarding materials for aircraft as well as details of aircraft construction and equipment. It is, for example, obviously desirable that aero engine magnetos made in different countries should be built within certain limits of overall dimensions, and should conform to general specifications which would enable a French magneto to be used in an emergency on a British machine finding itself in difficulties in France. The commission has already made gratifying progress, although it is unfortunate that the United States has so far been unable to appoint a committee to take part in its work. The countries now active on the Commission are Great Britain, France, Italy and Canada.

A grant of £200 towards the funds of the Association was announced from the British Engineering Standards Association, and the secretary reported that he now had in stock a supply of almost all of the publications of the B. E. S. A., which are available for distribution at a nominal charge.

A communication was read from the American Engineering Standards Committee, advising that in the opinion of the A. E. S. C. co-operation between that body and the C. E. S. A. should be provided for by the interchange of minutes of the meetings of the respective Main Committees, so that joint action could be arranged for, wherever necessary. The committee heartily concurred in this suggestion, which will be adopted in future, and the hope was expressed that many opportunities for co-operation would present themselves.

Three Kinks of Interest to the Machinist

UNIQUE FORM OF SCRIBER

By W. S. Standiford

The scriber as a tool for making lines upon steel and other metal surfaces, is used so extensively by machinists, workers in automotive shops and other trades, that a special interest attaches to any improvement that will render it handier to use. The regular form of scriber made out of a round steel rod, hardened at the points, has the drawback, when long or curved lines are being drawn, of shifting its position slightly in the artisan's hand—which is always more or less greasy—thus rendering it harder to hold, the line being drawn wider at some places than at others, due to the scribers wearing unequally on different sides.

In laying out templets which have to be filed to a line, this interferes, to some extent, with the accuracy of the filers' work and slows the latter down.

The scriber devised by the writer is easier to hold straight in any position, and it makes lines of equal width; it only being necessary to hold the handle in one position—either a vertical or a horizontal one—to ensure that the line will have the same width. So much for its advantages, now for the constructional details.

Get a piece of 5-32 or 3-16 inch round rod of high-carbon tool steel of the desired length. Heat it to a cherry red and bend the hot end around an iron rod in a vise. Cool in water, and place the end where the point is to be, in the fire, until it is red-hot. Quickly remove with a tongs and rapidly draw the end to a point with a hammer. When cool, grind it on an emery wheel until it is as round as possible; finishing any inequalities with a file or oil-stone, making a needle taper toward the point. Heat the business end to a cherry red and dip into water. Try the point for hardness by making a scratch on a flat steel plate. If the metal contains too much carbon, the point will crumble; if just right, the sharp point will hold. Should the former conditions prevail, sharpen the point again and heat it to a cherry red and plunge the business end in cold water, leaving some heat in the upper portion of the rod. Quickly rub one side, near the point, with a piece of emery cloth tacked on a block of wood, and watch the colors extend to the point; when a straw color is reached, dip into water.

The next thing to do is, to fill the handle with solder. Plunge loop in a chloride of zinc soldering fluid, which is made by putting pieces of sheet zinc into hydrochloric acid, until the latter will not dissolve any more. The above solution is a good flux of iron, steel, copper and brass, but should not be used for electrical work. After dipping, lay the loop upon a board and holding a hot soldering copper against a bar of solder, run sufficient of the latter in, until the handle is filled. Also lay the hot copper over the sides of the wire loop, as both the solder and meal requires to be hot, to do a good job. While soldering, cover the point with a wet cloth to prevent its temper being drawn. Remove all traces of acid by washing thoroughly in water; then grind the sur-

FIG. 1—SHOWS THE HANDLE OF SCRIBER BENT TO SHAPE AND THE POINT ROUGHED OUT.

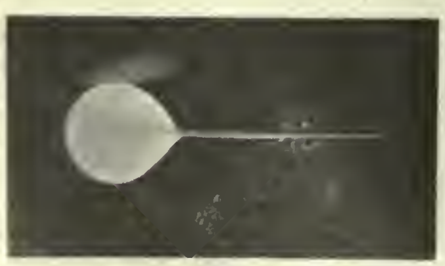
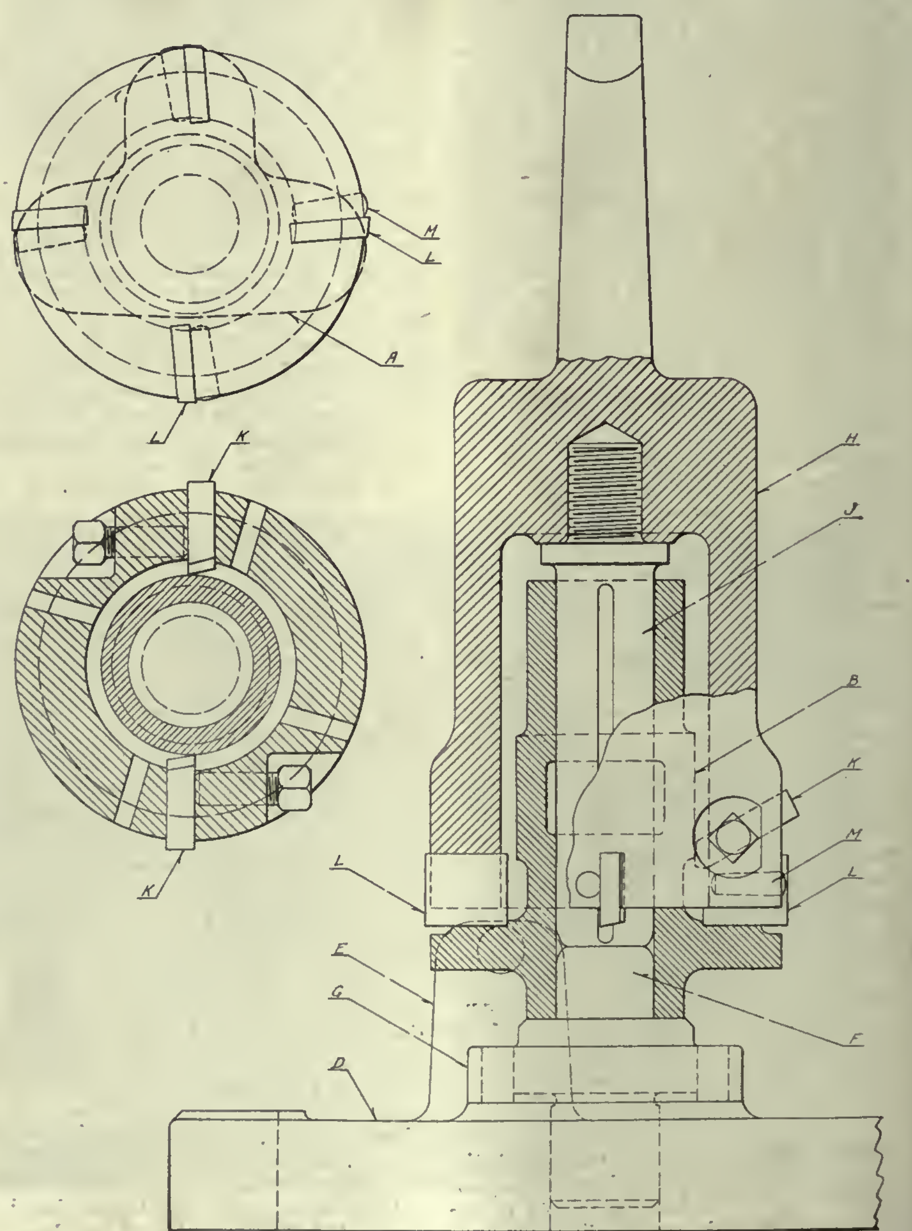


FIG. 2—REPRESENTS THE FINISHED APPLIANCE, READY FOR USE. A VERY EFFICIENT DEVICE.



SECTIONAL VIEW OF THE HOLLOW MILL.

plus solder off the handle, brighten every part with emery cloth and oil to prevent rust and it is ready for use.

Fig. 1 shows the wire handle bent to shape and the point roughed out.

Fig. 2 depicts the finished appliance ready for use. For use with a scriber in making templets, the writer has found out by experience, that a line drawn on a copper coated plate, shows more clearly than does one drawn upon a blue chalk-covered surface. Free one side of the plate from grease and dissolve a few crystals of copper sulphate in a small quantity of water in a bottle. Use a round brush to put it on the plate, which will instantly turn copper colored. Rinse and dry thoroughly, and it is then ready for use. Sulphate of copper is a poison, so be careful in handling it.

HOLLOW MILL FOR TURNING AND FACING

By A DRAFTSMAN

The piece to be treated is a hub casting with a three-lobed flange, A, the bore having previously been machined. The drawing shows a hollow mill, to be used on a large drilling machine, for turning a diameter, B, and a force, C, at one setting.

The baseplate, D, has a lug, E, and stop pin to prevent rotation of the piece, which is centred by the limits pin, F, having adjustment and a circular locknut, G. The body of the mill, H, is of steel and has a tapered driving shank. It carries an internal centering and limit pin, J, which fits the bore and is grooved to accommodate grit. Two square tools, K, for turning the diameter, are set in at an angle to the horizontal and are pinched by set screws with a slight forward rake. There are four tools for the forcing cut, this number being necessary to ensure that two will always be in operation on the irregularly spaced lugs. These tools, L, are located so that they do not come into action until the turning tools have neared the end of their cut.

The method of securing the facing tools is simple and effective. Before cutting the radial-faced slots, four holes are drilled at 5 degrees to the slots. Then the slots are cut, breaking into the drill holes. When each tool is inserted, a pin, M, with a flattened and tapered side, is knocked in alongside. Acting as a taper pin, it effectively prevents chatter.

TOOLHOLDER FOR TURNING TWO DIAMETERS

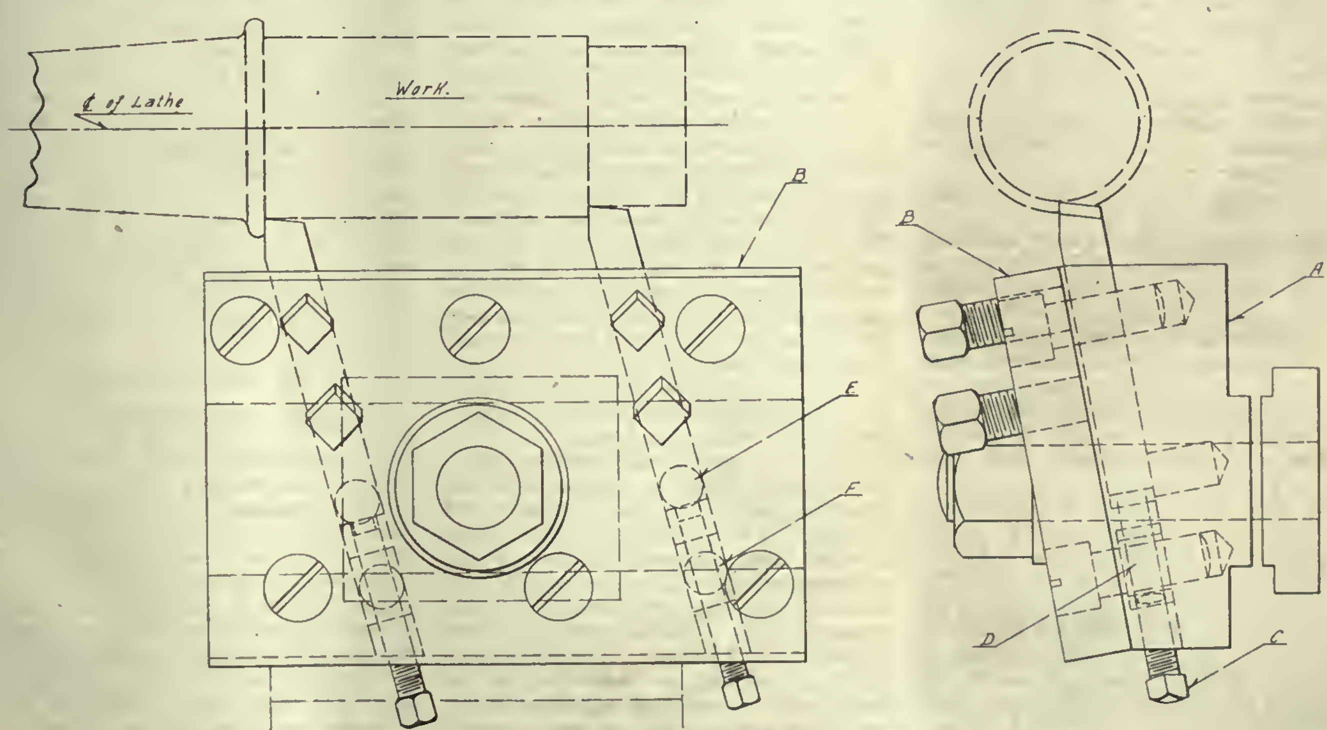
The drawing illustrates a device for simultaneously turning two diameters and shoulders on a shaft. It consists of a block A clamped by a central stud to the tool-rest of the lathe. The tools used are of ½ in. square steel and lie in slots at angles of 15 deg., both to the horizontal, and to the plane of the shoulders. A cover plate B, held to the block by six screws, carries set-screws by which the tools are gripped. Each tool is kept to its work by a long screw C passing through a T-block D, whose round stem engages with a hole in the bottom of the slot. Two holes E and F are provided in each slot so that the T-block may be moved forward and the overhang of its screw shortened when the tool has sufficiently worn down.

The advantage of this arrangement is that the double bevel on the tool faces enables the cutting edges to be easily ground and the two tools can be adjusted for height and distance apart of cutting edges as well as for relative diameters.

ACTION OF WATER ON LEAD

In a paper on "The Action of Water on Lead," read before the Birmingham and Midland section of the Society of Chemical Industry, the authors, Messrs. J. F. Liverseege and A. W. Knapp, said that the erosion of lead pipes is due to the action of oxygen in the presence of water; such variations as occur naturally in the percentage of oxygen preally in the water produce no appreciable effect on the erosion. Exposure to glass lowers the water's erosive ability. The greater the depth at which the lead is immersed in the water, the slower the erosive action. The velocity of the erosion falls as time proceeds; variation in the volume of water does not appreciably affect erosion. For the untreated water the amount of lead eroded varies directly with the area of the lead exposed. Small changes in the area of the water surface produce no appreciable effect on the erosion. Erosion readily occurs in waters which contain no carbon dioxide. Such variations as occur naturally in the percentage of carbon dioxide present in the water produce no appreciable effect on the erosion. The presence of from 1 to 2 per cent. of carbon dioxide causes a sudden change from "erosion" to "plumber solvency." Carbon dioxide dissolves lead more rapidly in the presence of oxygen.

The annual report of the Chief Inspector of Mines shows that the output of coal from the United Kingdom fell from 287,400,000 tons in 1913 to 227,700,000 tons in 1918, which represented the lowest output since 1902. The number of persons employed in the mining industry in 1918 amounted to 1,029,688, and there were 1,487 deaths caused by accidents.



DETAILS OF THE HOLDER IN PLACE.

Oil Burners, Their Function in Furnace Operation

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THE natural advantages of oil fuel have led to the development of many appliances designed to further its use, the most common of which are the so-called "oil burners." In the early days of burning oil it was generally assumed that the most essential requirement was an efficient oil burner, and such opinion is still quite common even though years of development have conclusively proved it to be in error. This assumption is responsible for a general misunderstanding of the real principles involved, and has in no small measure retarded progress in the efficient use of oil fuel. It also has retarded progress in the development of heat-treatment work, largely because there is not proper appreciation of the difference between burning oil, making heat, and properly applying heat to produce a uniformly heated product. The latter is the result actually sought for, everything else being a means to that end.

Generally speaking, there is no such thing in industrial heating as an oil burner in the sense that is considered with a gas burner or the burner of an oil stove or lamp. The very term is a misnomer, because the type of oil burner generally used for furnace work is not an appliance to burn the oil but merely a regulating, mixing, or atomizing valve to inject the fuel and air into the furnace in which it is actually ignited and consumed. The oil itself does not burn; it is a mixture of gas and air which burns. The gas from the oil generally used for fuel is generated under the action of heat at high temperature in the zone of combustion. The air may be supplied through or induced by the burner or in some other manner, and the supply must be regulated in proportion to the fuel to obtain proper results.

Efficiency of Oil Burner

The real efficiency of an oil burner is mainly mechanical as with any other type of spraying, injecting or mixing valve. Some types of burners may produce better results than others in atomizing or mixing, or from an operating standpoint offer greater convenience in cleaning, adjustment, interchangeability of parts, etc., but in general the efficiency is more mechanical than thermal.

The fuel consumption is determined primarily by the requirements of the furnace, and is largely influenced by the method of operation and not by the mechanical details of the burner itself. A great deal of oil is burned successfully on certain types of furnaces without the use of oil burners at all; in others the operation is conducted with air pressures so low that there is practically no atomizing effect from the burner, which serves merely to inject the air and fuel. Excellent heating results, with material reduction in fuel consumption, have been produced with new furnaces of improved design operated with old burners which have been in constant use for over twenty years.

There are some special forms of oil burners, such as torches for brazing, drying, lighting cupolas, spot heating, etc., with provision for maintaining combustion after a gas has been generated by heat and ignited, but these differ from the type generally used in connection with furnaces and designated by the term oil burners. On account of the high temperature necessary for the combustion process and the resultant expansion, contraction, and oxidation, these devices burn away in time. While very well adapted to these specific heating operations, which cannot well be conducted with a furnace, their use is unnecessary and unwarranted for general furnace operation.

A properly designed oil furnace is in reality a combination of a gas producer and a furnace and should be considered as such. The oil generally used for furnaces must be converted into a gas before it can be consumed, and this gasification process is conducted at a temperature too high for ordinary metal to withstand. When the nature of the heating operation and the design of the furnace will permit the gasification of the fuel within the furnace it is desirable that the process of gasification be conducted in a chamber lined with refractory material. This refractory combustion chamber is necessary on account of the temperature that must be employed to actually gasify the oil without deposits of carbon or tarry matter, which naturally follow any attempt to gasify oil at low temperatures. With the oils employed as fuel for furnace operation the high heats are absolutely necessary because it is impossible to form the gas by mixing the oil and air, or by mixing air with vapors of the oil—as in automobile practice—on account of the fact that these oils can be only partially gasified without heat.

Years ago it was thought necessary to convert the oil into a gas and deliver the fuel as gas to the furnace.

This unnecessary complication gradually brought about an appreciation of the fact that, with proper design and operation of furnaces, this work of gasification could be accomplished in the comparatively small space occupied by a suitable combustion chamber. This without any loss of heat outside of the furnace in gasifying the oil, difficulty in starting, and risk or discomfort to the operator by radiation or contact with the gasifying equipment or by the explosion hazard incident to the movement of combustible mixtures through pipes. For these reasons, if the nature of the heating operation and the size of the furnace will permit the use of oil it is better to gasify the oil at high temperature in a refractory combustion chamber within the furnace. But when the nature of the heating operation and the size of furnace make it desirable to employ a gaseous fuel, then that gas should be generated in a central station at a point distant from the furnace, and the gas, whether it be made from coal or oil, should be scrubbed of its tarry matters so that it may be delivered as a clean, cold fuel through a pipe, after the manner of the gas service in cities. In some cases, when the heating operation and manufacturing conditions make a gas fuel desirable, and the gas made from the coal is, by reason of its chemical composition or cost, unsuited to the operation, it is in order to consider the use of gas made from oil. To produce this gas it is necessary that the oil or a mixture of oil and air be injected into a retort heated to the temperature necessary to break up the oil and convert it into a fixed gas, and, in addition, to scrub and cool the gas so that it may be delivered through pipes without forming deposits. This is a true gasification process. Oil and air may be mixed at low temperatures, and if the oil is thoroughly atomized an oil vapor may be formed. However, this is not a gas and cannot be considered as such until it has been subjected to the temperature that is absolutely necessary for true gasification.

There is no one type of burner suitable for all heating requirements. The essential features are that it be properly proportioned to the oil and air or steam pressures available, and so designed that all parts are accessible and permit of close adjustment, cleaning and convenient removal from the furnace without affecting the operation of any other burner served by the same piping system. The position of the burner and arrangement of piping are determined by the design and location of the furnace.

General Rules

The same general rules apply whether the oil burner is of the high pressure type using steam or compressed air, the straight low pressure type using moderate air pressures, or of the combination type.

There are no fixed rules that can be laid down to determine whether air or steam should be used or the pressure at which it should be delivered, because the specific operating conditions of each case, coupled with the design of furnace, determine these points The real test is the effect upon the finished material and the total cost of installation and heating operation. There are certain cases to which steam, even at a higher cost, is well adapted, but the conditions determining the use of steam are based upon the ultimate result in heated product and not upon any combustion condition. When steam is employed it must be as dry as possible, and all lines well covered and trapped to avoid trouble from condensation. Higher pressures are more necessary with steam than air, not because the pressure is necessary for atomizing but because steam at a fairly high pressure will be comparatively dry when expanded at the burner tip. The existence of water seriously affects combustion, the character of the heat in the working chamber, the brickwork of the furnace, and increases the operating cost. The use of steam with a properly designed and operated furnace produces excellent results for certain classes of work, giving soft, even heats. Steam requires more attention than air, but when the operating conditions make it desirable the difference in results is well worth the extra attention. The use of steam is limited to certain types of furnaces by reason of the space required, temperature or other manufacturing conditions and the necessity for inducing all the air required to support combustion.

There is no one air pressure or type of blower suitable for all conditions. The use of air at pressures above 4 or 5 pounds per square inch involves the use of piston-driven compressors or other expensive water-cooled equipment, which are objectionable on account of the high cost of installation and operation. When the furnace equipment is small and compressed air is available, high pressures may be employed to avoid the installation of new blowing equipment; but as a general rule, in a new installation involving machinery to deliver air, the higher pressures are unnecessary.

In many cases when the design of the furnace permits, air at 4 or 5 oz. less per square inch may be employed to maintain clear fires without smoke or carbon deposit; in others, the design of the furnace makes it necessary to employ higher pressures in order to secure sufficient atomization of the fuel. When the very low air pressures are employed there is practically no atomizing effect—the air acting merely to support combustion and assist in the delivery of oil to the combustion chamber—the gasification being almost entirely brought about by heat and the action of the gases within the furnace.

Proper Air or Steam Pressure

The proper air or steam pressure to employ is invariably determined by local plant conditions and furnace design. Each case must be dealt with on its own merits. The purpose should be to adapt the existing air or steam equipment to the furnaces whenever possible so that the question in each case becomes one of delivering heated product at the lowest cost of installation and operation, all things considered.

High oil pressures are frequently employed for mechanical atomization of the oil without the use of air to assist in the atomizing process. This practice is common on marine and other large boilers for steam generation, and has many advantages in cases where the consumption per burner is relatively high, when the oil is of low gravity, and when the requirements for raising steam do not demand the refinement and control that is necessary for modern heat-treatment processes. The advantages of mechanical atomization in such cases do not hold good in the average heat-treatment plant, where, with properly designed furnaces, it is possible to secure the desired results without the mechanical equipment and high pressures necessary in boiler work. In average heating practice the actual pressure is not so important as the uniformity of flow because there is a material reduction in pressure at the needle valve of the burner, so that the pressure of the oil as it enters the furnace is invariably less than the pressure on the line. A slight variation in oil pressure will react more readily on furnaces where the consumption is relatively small than on steam boilers where the pressure on the steam line is generally controlled by a regulating valve.

The combustion of oil is based upon the same principles as those governing the operation of an ordinary coal or gas stove, gas or oil lamp. It is essential that provision be made to regulate the supply of air in proportion to the amount of fuel required to make the proper heat. If this is not done, improper combustion is likely to result, due either to insufficient air for the amount of fuel injected into the furnace or an excess of air beyond that necessary to complete combustion. It may react in a waste of fuel due to the necessity of injecting more fuel than is necessary for the heating operation in order to balance the excess air drawn into the furnace. This is what generally happens without proper control of all air entering the furnace. As the supply of fuel varies from the time of starting until the furnace is up to heat, it naturally follows that means should be employed to effect a corresponding variation in air supply. The burning of oil or any other fuel without provision to regulate every cubic foot of air supplied to the furnace, whether it is under pressure of not, results either in a waste of fuel or in a waste of material through inability to maintain proper heating conditions in the chamber.

Design and Operation

The design and operation of the furnace, and not the burner, whether the burner be for oil or gas, determine the nature of the combustion, the manner in which heat is applied to the heating chamber, the amount of fuel required to heat the material, and the uniformity of temperature throughout the mass to be heated. No type of burner or method of preparing or delivering fuel to a furnace will remedy improper furnace design.

The ordinary oil burner bears about the same relationship to the operation of a furnace that the spraying valve of a carburetter does to the operation of an automobile. It is just as useless to expect good service from a poorly designed or worn-out automobile through the attachment of a good carburetter as it is to expect perfect heating after attaching a good oil burner to a furnace which is not in condition to properly heat material after the heat is generated.

With the automobile, fuel is but one factor in transportation, and for the same reason it is with the furnace but one factor in the production and cost of uniformly heated product. In either case it is the proper combination of all the factors involved that produces the result. Generally speaking, a difference in fuel consumption reflects a difference in the construction or operation of the furnace. Often, however, it is attributed illogically to the burner which performs no other function than that of injecting the supply of fuel and air, the proportions of which are under control of the operator and the effective use of which is determined almost entirely by the furnace design.

Good combustion is not necessarily an indication of fuel economy in the operation of a furnace. It may be possible to show good combustion through analysis of flue gases and at the same time waste fuel in a poorly designed furnace through improper location and size of vents, discharge of gases at unnecessarily high temperatures, excessive radiation through light walls or bottom, lack of control of the gases leaving the furnace, or difficulty of properly applying the heat to the material in the chamber, regardless of how good the combustion may be. It is possible to show good combustion in a furnace lacking provision to control the supply of air by delivering sufficient fuel to balance the air actually supplied. A good fuel gas analysis from such operation is surely not an indication of fuel economy. It is possible to maintain relatively good combustion, with fuel economy, in a furnace that would be well designed from the standpoint of utilizing the heat and yet very poorly designed from the standpoint of properly applying that heat to useful work. This is equivalent to maintaining good combustion in a good engine, the power of which is not applied properly to the driving wheels of an automobile. Unless there is proper heating of material or good results in the form of transportation, fuel economy in furnaces or automobiles is of little value, and unless there is proper design and operation of the furnace or automobile, oil burners or carburetters cannot in themselves produce the results sought for.

There is no one system of burning oil. Practically all the methods employed are substantially alike and the governed by the same principles, which are not changed by variation in mechanical detail. The fundamental factors are the delivery of oil at a uniform pressure, with proper provision to insure oil free from water and foreign matter, absolute control of all the fuel and air entering the furnace,

(Continued on page 441)

The Use of Chain Drives on Grooved Drums

This Article From "Practical Engineer" Emphasizes the Importance of Studying Lead of Chain Before Going Ahead With Layout of Drive, in Order to Minimize the Wear on the Chain and Drum

By G. H. Roberts

THE lead of a chain or rope from a grooved winding drum is a matter which, in the opinion of the author, is seldom given the full attention and consideration that it should have, with the inevitable result that when haulage takes place much more wear and tear occurs on the chain, drum, and fair-lead than would actually be the case if greater thought had been given to the original lay-out of the arrangement. While admitting that site conditions or requirements do not always lend themselves to the ideal scheme, as referred to later, nevertheless a better compromise between theory and practice could have been applied to innumerable saving in wear and tear and considerable saving in wear and tear effected, with its consequent increase in life of the various parts directly affected.

Before dealing with the different chain leads, it may be advisable to briefly refer to certain features in regard to the drum itself, and also the chain. The diameter of the drum has much to do with the useful life of the chain, and, although there appears to be no predetermined or recognized ratio between the two—as there is in deciding the minimum diameter over which a steel rope should work—still it should be kept as large as circumstances will permit. If too small a diameter drum is introduced with heavy loads, the links will be subjected to considerable distortion in their attempt to adjust themselves to the surface of the drum barrel.

Fig. 1 shows in a slightly exaggerated sense the tendency of the horizontal links to bend when stressed in working. Theoretically this condition will always occur, no matter how large the diameter of the drum or sheave, but the possibility of fracture in the link through this cause will practically disappear if reasonable sized drums and short-link chain are used in conjunction with heavy loads.

Again, the length of the drum may have something to do in settling its diameter, as the whole should be so designed that any possibility of the chain coiling up on itself is obviated. A long barrel is objectionable, as will be observed later; this, however, should not be cut so fine that no latitude is provided for an additional coil or two—this should always be allowed for, even though the need appears unlikely to arise when the machine is in use. Two or three "dead" turns are frequently provided for at the fixed end of the chain; these, as the name implies, never pay off, their duty being to relieve the stress on the anchorage and prevent any irregularity at the beginning of the haul. The "live" coils are those whose total length are equivalent to the possible travel of the load. The length of the drum is therefore made up of three distinct parts, as indicated on Fig. 8. With regard to the grooving, care must be taken that the running clearances are no more than actually required; if the channel is made too wide, an insufficient seating is obtained for the links, and they are likely to bind in the groove, as shown in Fig. 2. There is always a tendency for a chain to do this, due to the twisting effect which occurs when winding begins. Cast grooved wheels are the greatest defaulters in this respect. In Fig. 3 are indicated four of the most common chain lead arrangements, where a fair-lead wheel is introduced to deflect the chain in the desired direction. These are enumerated as follows:—

(A) Horizontal lead with pull downwards.

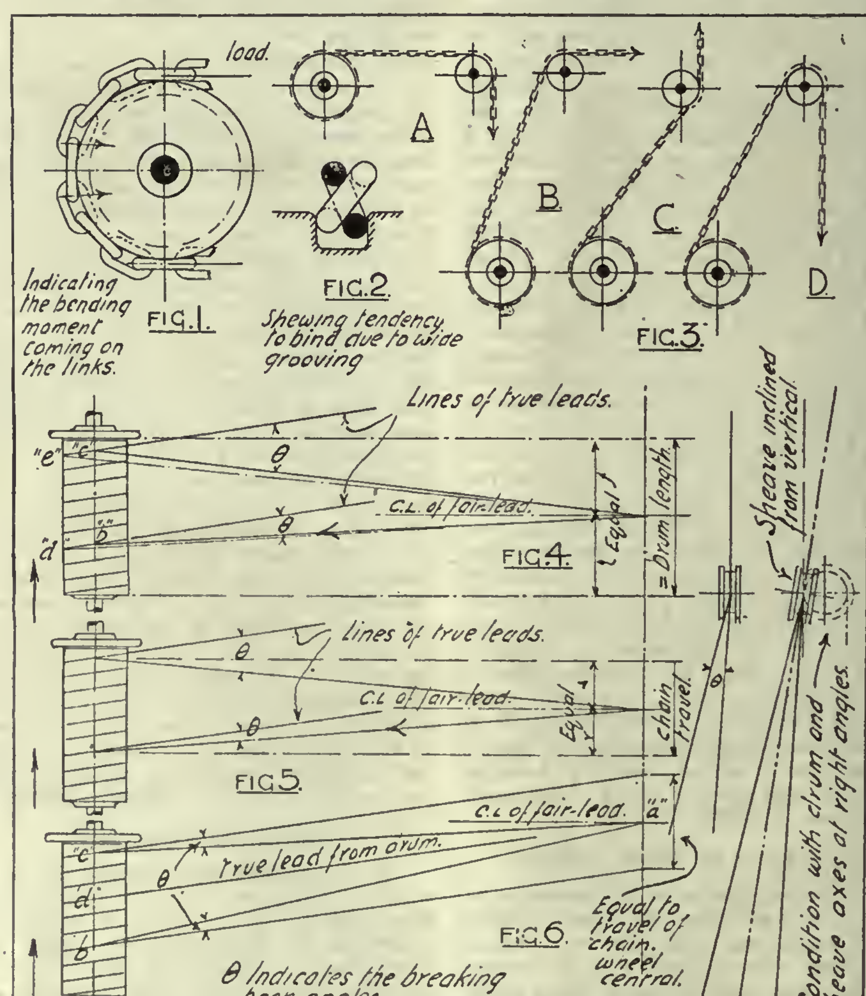
(B) Inclined lead with horizontal pull.

(C) Inclined lead, chain deflected upwards.

(D) Inclined lead with downward pull.

There are, of course, other arrangements, but the foregoing will be sufficient for the purpose of this article.

With diagram A it will be found that in numerous cases the relative positions



in plan of drum and lead wheel will either be as Figs. 4 and 5. What is the effect on the chain and grooving ? In Fig. 4 the fair-lead has been placed practically central with the total length of barrel, winding being in the direction indicated by the arrow head. Assuming that, say, three "dead" turns have been allowed, then at the beginning of the haul the chain follows the line a b, and at the end of the full travel will be as a c. These, as will be readily seen, do not represent the true lines of force, these latter geing respectively a d and a e, and to which the chain is continually trying to align itself, but prevented from doing so by the grooving in the drum. The detrimental effect of this is at once apparent, the resultant pressure increasing as the chain works its way along the drum, as will be observed on reference to the diagram in question. As a result, excessive friction and wear to the groove sides and the links is constantly taking place, and the heavier the load the greater will be the adverse conditions under which the machine will have to work. In Fig. 5 an improvement is made. Here the lead wheel occupies a position central with the total travel of the chain along the drum. This reduces the breaking-back angle o, and consequently lessens the wear and tear on chain and grooving. Scheme 6 represents the best practical solution with a fixed lead sheave, i.e., a sheave limits of chain travel along the barrel having been settled, the distance between is halved and a line produced parallel to the helix line of the pitch angle, as a d, point a being the first point of contact with the guide sheave. If points a, b, and c are now triangulated, it will be observed that the breaking-back angle at start and finish is considerably reduced, while at mid-travel a perfectly true lead is obtained. The working conditions on drum and sheave are therefore very much improved by this arrangement. Where the fair-lead can have freedom to slide along its spindle, and the lead is also free to adapt itself to varying horizontal positions, then a very satisfactory arrangement is arrived at, and one which can be further improved if the spindle of the sheave is moved round until it is at right angles to the chain lead, as indicated. This considerably reduces the running friction between sheave and spindle, the only wear now occurring being due to the sliding action along the shaft. If such an arrangement of guide sheave is applied to the former examples, it will undoubtedly help matters, but never entirely eliminate the breaking-back of the chain as it winds on or off the drum. The three diagrams just described are drawn to the same scale, so that they indicate proportionately the different conditions, the pitch angles being increased for the sake of comparative clearness.

Fig. 7 illustrates the practical application of Scheme 6, wherein the winding drum is shown moved round until the lead wheel spindle is parallel with the outside datum.

For various reasons it is not always practically convenient to apply the last scheme on the skew, as indicated, because, as a general rule, the lengthwise centre line of the machine must be at right angles to the loading face, taking an ordinary runway cat-head hoist as a case in point. In order to meet such requirements and still maintain arrangement No. 6, it is adjusted until the centre line a d is in the desired position, the angle through which it is moved being, of course, equal to the pitch angle, as shown in Fig. 7. The drum now occupies the angular position, but this, in the majority of cases, will not be found a practical objection ; generally the other parts of the gear and supports can readily be arranged to meet this particular feature.

Considering now the three remaining leads B, C, and D, it will be noted that the scheme shown, Fig. 6, still retains superiority over the other two, although with an inclined or vertical lead to sheave; skewing the drum on its base a small amount does not help matters much, but if it is turned round until the axes of drum and sheave are at right angles to each other, then the conditions illustrated in Fig. 6 with fixed sheave are obtained, with the added advantage that no breaking back on the sheave groove occurs. This relative arrangement of drum and wheel, as will be conceived, is equally applicable whether the chain is led upwards or horizontal or has a downward pull. With parallel axes there will always be a certain amount of breaking back on the fair-lead sheave; this is unavoidable. But with a fairly long lead between drum and sheave this does not amount to much, and is to all intents and purposes practically the same in all the cases referred to. The fixed sheave could, of course, be inclined to suit the central lead, if so desired, but no real practical purpose is served in doing so unless the chain has to follow such paths as indicated by the chain-dot line in Fig. 8, and then circumstances must decide if such a modification is necessary.

Too often conventional methods are blindly followed, with the result that Schemes 3 and 4 are continually perpetrated ; the introduction of arrangement 5 may disturb previous routine, but it is a good thing to create a precedent sometimes that has distinct advantages.

The Randfontein Central Mine, Transvaal, is going to install what, it is claimed, will be the largest electric winders in the world. They are to be capable of raising net loads of five tons each from a depth of 5,000 feet at 4,000 feet per minute. The Crown Mines winders, which have hitherto held the record, can raise eight tons net some 3,500 feet at the same speed. An American firm is likely, according to the "South African Mining and Engineering Journal," to be successful in tendering for the electrical part and a British firm for the mechanical part.

OIL BURNERS, THEIR FUNCTIONS

Continued from Page 439

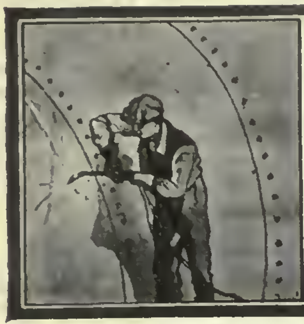
regulation of the air in proportion to the fuel required, control of the gases within the furnace, the application of the heat generated to a design of furnace that will permit of a uniform distribution of heat not merely in the furnace when empty, but to the material in the furnace when it is loaded to normal working capacity. There is nothing in the nature of the fuel or of any appliance employed to burn it that will make up for the lack of these essentials, which form the basis of all heating operations regardless of the fuel or method of burning it.

A vast supply of sodium sulphate—Glauber's salt—is represented by the deposits of some of the lakes in Siberia. Lake Marmyshansk alone contains about 2,600,000 tons, and altogether there must be over 7,000,000 in the various lakes.

There is a proposal on foot to institute an aerial service for the transportation of passengers and merchandise between the United States of America and the Island of Jamaica, via Havana and Santiago in Cuba. An aviation station will be constructed at Miami or at Key West, in Florida. The service will, it is anticipated, most probably be started before the summer.

The Australian grass tree, locally known as the "blackboy," say the "Engineer," grows to a normal size of from 7 feet to 10 feet. The tree contains gum in large quantities, and amongst other by-products extracted under treatment are tars, free from harmful acids, tarpaulin dressings, rope and sanitary tars, lacquers—such as Japan black—steam refrigerating pipe lagging, paint for ironwork that requires stoving at high temperatures, stains and paints, phenol, benzol and alcohols coke, potash, and pyrogeneous acid. Although until recently no attempt has been made to utilize this tree commercially, a company has now been formed to extract and market its by-products.

The iron mines of Bell Island, Newfoundland, are among the most remarkable in the world, says "The United Empire. There are two areas, both rich in iron ore, one of which has an annual output of 700,000 tons, and is credited with a supply which would be sufficient to last at this rate for nearly 250 years; while the other, with an annual output of 600,000 tons, is believed to contain enough ore to last for about 3,300 years. Newfoundland may, therefore, be regarded as having an almost inexhaustible supply of iron. The mines are conveniently situated near the coast, where ships of 7,000 tons can be loaded in six or seven hours. The iron is then sent to Nova Scotia for smelting and refining processes.



WELDING AND CUTTING

Lessons on the A.B.C. of Good Welding

This is the Third Lesson by an Authority on the Subject — The Remainder of the Series Will Follow

By W. B. Perdue*

IN the training of welders, my policy has always been, "Let them master some of the difficult problems first." This tends to discourage those who lack the initiative necessary to carry the work to success, while those who have the broader vision are encouraged by the fact that such welds as they are able to make excel in appearance and efficiency those made by the average journeyman.

Consequently the student is never permitted to waste time in fusing together the edges of thin steel plates without the addition of filler rod. The operator who learns to weld properly can do this without instruction. He must, sooner or later, learn to weld with rod—the sooner the better.

Having acquired sufficient proficiency in the manipulation of the rod and torch to enable him to execute a neat "ripple" 24 inches long on the surface of a steel plate, the student should begin practise in welding together thin plates six or eight inches in length. The muscular practice necessary to acquire proper and symmetrical movement of the torch must be continued. How long? For several weeks—at least until any movement of the left hand or any diversion of thought does not affect the regular swing of the torch.

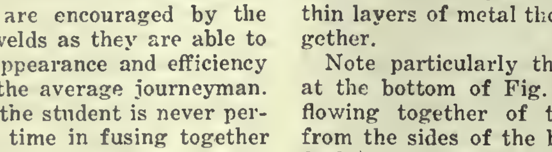


FIG. 7.

The accompanying illustrations are intended to assist the beginner in mastering two very important points, viz.: Penetration and contraction.

Method for Practice

Having prepared and set up the pieces in accordance with the suggestions given in the illustrations, the operator is ready to begin practice. The edges of the bevel are fused together at the right; then material added by plunging the filler rod into the melted pool thus formed and vigorously stirring it about; the completed weld being a series of extremely thin layers of metal thoroughly fused together.

Note particularly the capillary curve at the bottom of Fig. 7, caused by the flowing together of the melted metal from the sides of the bevel. A common fault is to allow the flame to get behind the melted metal, instead of keeping it ahead of the sloping fill in the position indicated by Figs. 2 and 3.

Failure to keep the flame on the sloping side of the fill prevents proper fusion of the edges and results in the melted metal from the rod being blown over them and adhering thereto without forming a proper bond. When this happens the weld will be defective.

There is a very simple reason why this happens with the beginner. In starting a new fill he does not bring the flame far enough to the right. When he notices that there is a gap that is too low he promptly carries his torch further to the right. Instead of producing the desired result, this melts down the fill previously formed, and, instead of moving the flame rapidly to the left and getting ahead of the melted metal to blow it back, he keeps trying to add rod in the flat hole which keeps continually growing larger. As soon as he learns to keep his flame to the left of the melted pool the metal will automatically pile up in proper form.

When welding has commenced it should be carried on continuously. Even in the thickest sections of metal it is necessary to execute the successive fills with sufficient rapidity to hold the whole mass at a bright white heat. In practice the experienced operator performs these motions in such rapid succession that they can not be noticed by the observer. In most cases the operator himself is not aware that a successive series of fills are being made, and is therefore unable to properly describe the process to the uninitiated.

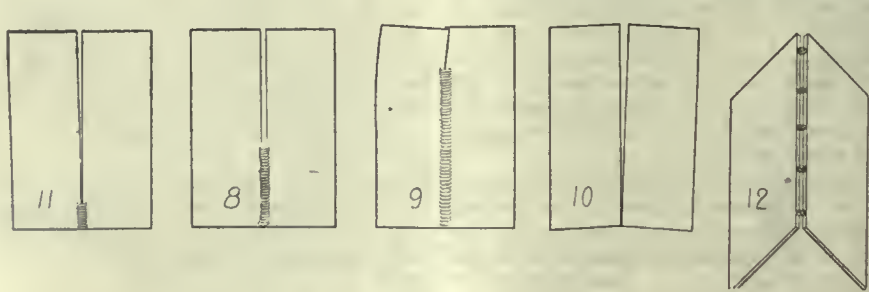
Checking Up Results

There is no good reason for lack of penetration. As soon as a weld is fairly started the reverse side should be examined. If proper penetration has not been secured the weld should be broken, the edges rebeveled, and a new trial made. The beginner should inspect his practice pieces at least every inch until he secures proper penetration without difficulty.

As soon as two parts are welded together with apparent good penetration they should be broken apart by gripping them in a vice at the line of welding and hammering against the upper plate on the same side as the reverse side of the weld.

If all these who have out their shingles as "Professional Expert Welders" would but condescend to make such tests occasionally, and to profit thereby, all complaints about the oxy-acetylene process would cease to be heard.

The selection of tips of the proper size deserves more attention than is generally given thereto. The average



VARIOUS EXAMPLES OF SHRINKAGE OF CONTRACTION IN WELDS.

*Director Welding Department, Healds Engineering School, San Francisco, Cal., also manufacturer of Perfectype acetylene generators, torches, and regulators.

welder either fails to get the metal in the vicinity of the weld hot enough to properly fuse together, or attempts to use a tip so large that he can not "stay on the job," and burns or oxidizes the metal in and near the weld.

The incandescent white cone should be brought very close to the metal in the weld. In welding steel the extremity of the cone is brought into direct contact with the metal and produces melting. This is because the melting point of this metal is very high. In welding cast iron the point of the flame is held extremely close but not in contact with the metal. The flame is also held quite close to aluminum, but at a greater distance for welds in copper, brass, and bronzes. Methods of handling these metals will be more fully explained later.

Burning the Metal

At this point it seems necessary to explain that "burning" the metal is not the effect of heat, but that the burning of any substance is caused by the chemical combination of itself and oxygen. Steel is often "honeycombed" by the burning out of a portion of its carbon content by the action of oxygen. Certain operators are able to execute a fairly good weld in those steels in which the percentage of carbon is quite low, but have little or no success with medium or high-carbon steels.

"Burning," as applied to steel, means the chemical combination with oxygen of the iron, or some of the elements with which the iron is alloyed. It may be caused by:

1. The use of a torch which supplies an excess of oxygen to the flame.
2. Improper manipulation of the torch, which does not protect the vicinity of the weld from attack by the oxygen of the air.
3. Improper distribution of heat in the parts to be welded, whereby violent reactions are set up in the zones between the heated and the cold areas.

The ability to exercise better control over the last mentioned items is but another instance of the superiority of the acetylene over other methods of welding.

From the foregoing it follows:

1. That the weld should be executed without any appreciable change in the composition of the parts welded.
2. That the filler rod should be of similar analysis to the parts welded, or sufficiently so to avoid the blending of metals, the physical properties of which may set up internal strains within the weld.
3. That the torch which does not stir the gases into perfect and uniform mixtures can not produce a sound weld.

The ordinary torch drives an excess of oxygen through the welding flame. This, in turn, drives before it a portion of partially-burned acetylene in the form of carbon. To partially absorb this carbon many welders use "Norway" or "Swedish" wrought iron wire, which contains very little carbon. In this manner it may be possible to produce a "sound" weld and at the same time "kill" the metal on either side.

In the selection of filler rod American products of known chemical analysis and the use of low carbon steel rods free from impurities of phosphorus and sulphur for welding steel products will be found most satisfactory. The welder who thoroughly familiarized himself with the methods of regulating and testing the flame, given in the previous chapter, will be able to note any minute change that may be effected by the refrigeration of the gases in passing through the regulators. This, with proper manipulation of rod and torch and the selection of proper equipment, will insure the production of welds of maximum quality. It is a matter of common occurrence for a student, soon after taking up the trade, to produce welds in alloy steels which, after proper heat treatment, will withstand a tensile pull of from 60,000 to 150,000 pounds.

It is needless to state that these results can not even be approached by the use of any form of iron wire, or by any other known process of welding.

Contraction or Shrinkage

All metals are affected by heat. Its action produces an increase in volume; that is, a piece of metal when heated has greater length, breadth and thickness. Experiments have proved that most metals continue to expand until they reach the plastic state, just before they reach the melting point. In cooling they contract, or decrease in volume, until at normal temperature they assume a normal size.

Any attempt to prevent this action on a welding job would be futile. If clamps strong enough could be secured the distortion of the part welded would result, and some trouble would arise from its use. Many welding jobs are of complicated and irregular pattern, the various parts of same varying in thickness, therefore some study must be made of the effects of contraction and expansion, which will be more fully dealt with later. Setting up a weld in such manner as to secure proper alignment of parts should become a matter of pride. The welder is not a mere machine—he is an individual whose success depends upon the development of his own ingenuity.

If, while making the weld, he ignores the fact that contraction must result from its cooling, one of three things will occur:

1. The work will break in the weld or at some point affected by the shrinkage of the metal in the weld.
2. The work, if it does not break, will be distorted and the alignment of its parts destroyed.
3. The weld may not break and the strength of other parts may prevent visible distortion, but there will be an internal strain, which will weaken it and may cause it to break after it has been placed in service. This is most disappointing, and in many cases expensive, since all labor of dismantling and replacing is, in such cases, unnecessarily performed.

Various results of contraction, due to the cooling of the metal in the weld, should be carefully studied, the process reasoned out and proper means thought out for the prevention of such unpleasant results.

Practice on thin pieces, not over a foot long should be continued until the proficiency of the operator enables him to reduce the angle of separation to one-fourth inch or less per foot. The ability to execute a weld in such a manner that the angle of separation is reduced to a minimum is an accomplishment well worth cultivating.

AUTOGENOUS WELDING RULES

The following rules have been adopted by the Committee on Standards for the purpose of preventing the use of autogenous welding for purposes for which it is not well adapted. These have been sent to the regional directors with instructions to direct all roads to observe the rules in the construction or repair of locomotive boilers, so that any failures which may have been caused or contributed to by unrestricted or improper use of autogenous welding may be prevented.

The Committee of Standards, after carefully investigating the use of autogenous welding in connection with the construction and repair of locomotive boilers and fire boxes, has in the interest of safety and efficiency adopted the following rules:

1. Autogenous welding will not be permitted on any part of a locomotive boiler that is wholly in tension under working conditions; this is to include arch or water bar tubes.
2. Staybolts or crown stay heads must not be built up or welded to the sheet.
3. Holes larger than 1½ inches in diameter when entirely closed by autogenous welding must have the welding properly stayed.
4. In new construction, welded seams in crown sheets will not be used where full-size sheets are obtainable. This is not intended to prevent welding the crown sheet to other fire box sheets. Side sheet seams shall not be less than 12 inches below the highest point of the crown.
5. Only operators known to be competent will be assigned to fire box welding.
6. Where autogenous welding is done the parts to be welded must be thoroughly cleaned and kept clean during the progress of the work.
7. When repairing fire boxes, a number of small adjacent patches will not be applied, but the defective part of the sheet will be cut out and repaired with one patch.
8. The autogenous welding of defective main air reservoirs is not permitted.
9. Welding rods must conform to the specifications issued by the Inspection and Test Section of the United States Railroad Administration for the various kinds of work for which they are prescribed, which specifications will be issued later.

DEVELOPMENTS IN SHOP EQUIPMENT

HIGH POWER RADIAL DRILL

Joseph T. Ryerson & Sons have placed on the market what is known as their Ryerson-Conradson High Power Plain Radial Drilling Machine. This machine is equipped with twin motor drive and differs materially from the usual design. Drilling, tapping, boring and reaming can be performed with equal efficiency.

The machine has only four shafts and sixteen gears, without sacrificing the range of work possible to be performed. The spindle and driving shafts are all contained in a single cast box of rigid construction. Only spur gears are employed, eliminating bevel gears and the consequent trouble of keeping them aligned.

The head mounted upon S. K. F. ball bearings, travels on the top surface of the arm and is held in place by a plate which is guided by parallel V's on the under side of the arm. This plate serves various purposes, chief of which is to keep the head in perfect alignment with the arm. These features eliminate all torsional strains on the arm as well as overcoming the difficulty of keeping the spindle properly aligned when the usual side mounting is employed. Cross traverse of the head is carried on ball bearing rollers provided with eccentric shafts which permit adjustment for wear.

Spindle Drive.—A reversible motor is mounted on the head and directly connected to the drive shaft by means of a self-aligning, internally splined coupling. This drive shaft carries a pinion and gear, the pinion being cut integral with the shaft and both run in mesh at all times with clutch gears of the conical friction type. The friction cones are mounted on a spacing rod and a movement, up or down, from the neutral position engages the high or low speed clutch gear. Four other gears are keyed to this clutch shaft and drive the spindle sleeve over change gears on an auxiliary shaft. The auxiliary shaft is splined and the change gears are shifted by two shifter yokes which, in turn, are actuated by interlocking levers, making it impossible to engage two sets of gears at a time. Each end of the auxiliary shaft carries a pinion, permanently in mesh with bronze bushed gears on the spindle sleeve. A jaw clutch engages one or the other and affects the drive. The spindle has two keyways cut its entire length and is driven by two inserted keys in the sleeve. By shifting the levers, all of which are on the head, the operator engages the entire speeds.

Sixteen spindle speeds, ranging from 9 to 310 R.P.M. in practical geometrical progression, are obtained in this manner.

For tapping, the motor is reversed, which is instantaneous and entirely eliminates all shock in the transmission. All gears are cut from solid alloy steel forgings and heat treated. The head is completely enclosed and all gears run in oil, a gauge indicating the level to the operator. All shafts run in S.K.F. ball bearings, which results in a low power consumption.

Feed.—Two series of 8 feeds each, ranging from .005 in. to .078 in. and from 023 in. to .370 in. per revolution in practical geometrical progression are provided. Feed changes are secured by a cone of gears in connection with a dive key controlled by a feed indicating dial and also by engaging in upper or lower position a clutch controlled by a lever on the hand wheel.

All feeds are disengaged instantly by a friction clutch on the hand wheel shaft, which is actuated by a lever conveniently located on the head. By the use of an automatic or adjustable stop, feeds are disengaged when the desired depth is reached.

For raising and lowering of the arm an independent motor of the elevator type is mounted on top of the column. A pinion is keyed directly to the armature shaft and drives a reducing gear on the elevating screw, the thrust of which is taken up by a ball bearing. This composes the entire elevating mechanism, doing away with the shock of engaging gears, which, in course of time, produces a noisy machine. Limit switches are provided and consist of standard

GENERAL APPEARANCE OF THE DRILL.

units. These are equipped with a bracket carrying a roller which opens the circuit when struck by the sleeve of the arm.

The design of arm is of box section type, heavily reinforced and capable of reducing to a minimum all sagging or springing when high speeds and feeds are employed. The arm revolves on ball bearings and is carried by a sleeve of exceptional length, to which the elevating nut is attached. Means are provided to clamp the arm securely to the column, with equal pressure at the top and bottom simultaneously. Pneumatic clamping device can be furnished if desired. The centre of the spindle is arranged to travel on a radial line, passing through the centre of the column.

The column is a hollow cast iron cylinder of more than usual dimensions, firmly bolted to the base. An internal web is cast in the column in the line of strain, greatly increasing the rigidity. The base is practically of box section, stiffened by traverse and longitudinal ribs which are of the inverted "T" type bearing on the foundation and supporting the base throughout its entire length and width. Surrounding the base is a deep flange which materially stiffens it and serves as an oil retainer. The main base has an extension which carries a box table of generous proportions with an accurately planed top and side surface which are provided with large "T" slots.

Machines are furnished with the necessary main driving and elevating motor, both of the reversing type. These are operated by control apparatus consisting of reversing contactors, auxiliary units, two knife switches properly mounted in a steel cabinet, and two master control switches for any desired standard current and voltage. In addition, an overload relay and under voltage release for main driving motor only is supplied. The former of these two items is not part of the regular equipment and is considered an extra.

AUTOMATIC DRILL GRINDER

The Bellevue Industrial Furnace Co., Detroit, Michigan, have placed on the market their line of Automatic Drill Grinders. This style grinder was designed and constructed with the idea in mind to both economize on time and material. They state their claims in the following manner:

To our belief it is impossible for anyone to repeatedly sharpen a drill to perfection by hand, no matter how good a mechanic they may be. Very few people have eyesight good enough to see the proper point on a drill without the continuous use of the gauge, which also takes a great deal of time.

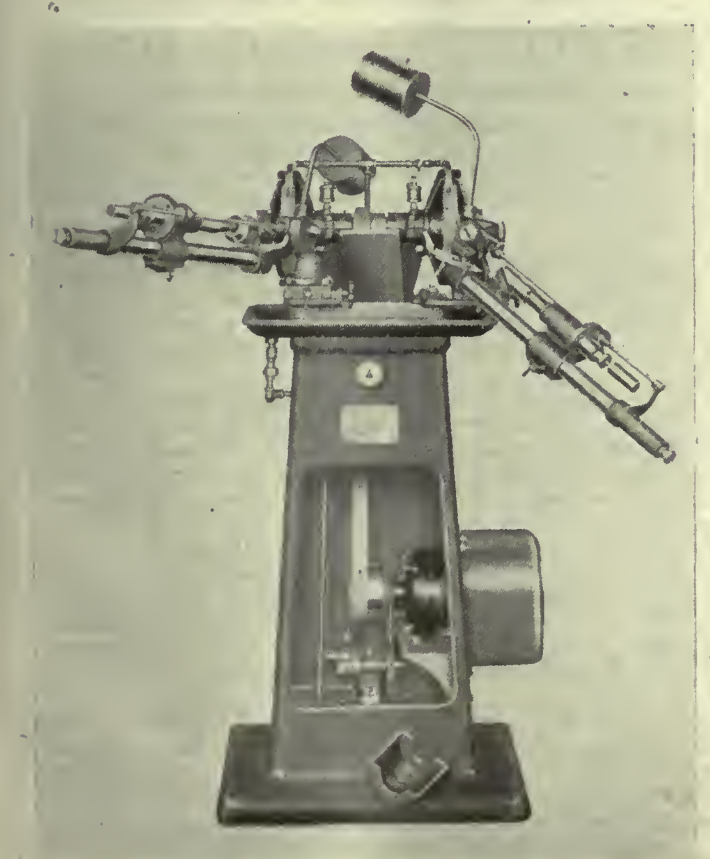
The automatic drill grinder can be easily operated by a boy or girl.

The grinder can be equipped with carriages for left hand drills as well as for right hand drills. A two, three, four or more lip drill can be sharpened on the machine. An index is provided that sets the lips so that each lip is ground perfectly, and a gauge for setting drill in carriage insures that no more stock is taken from drill than is necessary. Lathe centres can also be ground quickly and accurately.

Another interesting feature of the machine is that it grinds on the circumference of the wheel instead of on the side. This results in greater wear and longer life to the wheel. When the wheel needs trueing a diamond or other sharpening tool is placed in the chuck and brought forward to the gauge, as is a drill for grinding. The carriage is then operated across the circumference of the wheel by a cross feed and the wheel is trued exactly and without waste.

The machine is driven by an electric motor contained in the pedestal and is equipped with two-step pulleys so that two speeds are available. It can also be driven from the line shaft.

Manufacturers are said to be turning their attention seriously to air cooling for the engines of small cars. Autocar sees in the possibilities of air cooling a chance for the British manufacturer to get ahead of foreign rivals, for in no country has more careful research work been done and more progress made in the design of air-cooled cylinders during the war.



VIEW SHOWING MOTOR MOUNTED IN PEDESTAL.

THE GRINDER EQUIPPED WITH ONLY ONE CARRIAGE.

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PRINCIPAL CONTENTS

Do Mergers Increase Prices?

THE matter of the big steel-shipping merger, now completed, came up in the House at Ottawa this week, and the question was put whether the Government intended to stop it.

"This new merger," said one member, "is capitalized at nearly a billion, and is almost consummated. The question is whether the Government should not take steps to stop this huge merger, which will most likely result in an increase in rates."

It would be interesting for this member of the Dominion House, seeing that the Canadian merger is primarily a steel concern, to look over the trend of prices of steel on this continent.

He might be surprised to learn that Canadians—and we depend largely on United States for steel—have bought at a much lower rate from the United States Steel Corporation than from any of the independents and smaller mills.

The United States Steel Corporation adhered to the regulated schedule of March 21, 1919, and is still very close to it.

The independents, on the other hand, are selling steel at a stiff advance over the March 21 schedule.

The U.S. Steel Corporation has been, and is yet, the one agency that has stood in the path of a runaway steel market.

There seems to be an opinion that the word "merger" implies a gouging of the people. In the steel trade the evidence does not bear this out.

There is right now a concrete example in the steel trade of this continent. In fact it is so marked as to lead to the belief that the Steel Corporation is too low or the independents and premium mills too high—and in this connection it is well to remember that the Corporation is neither passing up dividends nor going into liquidation.

New York Gets After The Gouger

SEVERAL meetings have been held at different points to protest against the prices of potatoes, sugar, etc.

These meetings afford a good chance for people to state their case. Misery likes company, hence the sessions are well attended.

Farmers sold lots of potatoes in the fall for $2 and $2.50 per bag. That price represented the finished article. All the necessary labor had been expended. The difference between that price and the present $7 and $8 per bag represents the amount of gouging that has been going on since.

It is also a monument to the inability of the Government officials to put a crimp in the profiteers.

This week three dealers in New York City were arrested for profiteering. That is exactly what they call it.

They don't throw up a smoke screen and call it the high price made necessary by excessive production costs.

The first two arrested in New York were charged with selling 5,000 pounds of sugar at 25½ cents a pound, which they were alleged to have secured for 14 cents. The third sold at 22 cents and made 8 cents a pound. Bail is set at $1,000 each.

The jail is a mighty good place for the gouger and the financial glutton. Too bad that lenient officials admit that bail applies in all such cases.

Chance To Start Right

THE Secretary of the Navy at Washington is offering a lot of vessels for sale at bargain prices. That's what he means, although the official document puts it that they are "appraised low for immediate sale."

There seems to be a very good opportunity for some of the malcontents to start a brand new war. They could start out with buying a cruiser. There's a nice one offered for $225,000. No guns go with it, but these can easily be secured.

Then there are patrol boats, yachts, tugs, etc., in fact, everything except first-class battleships.

If you are not satisfied with present conditions, step right up and buy a fleet.

Where Good Times Hinge

THE stock market has been having several convulsions and near-convulsions during the past few days.

Shivers have gone up and down the financial spine of speculators, and they have predicted blue ruin and bread lines.

Fortunately the bread and butter of the country does not depend on the scares and shivers of the stock market.

The coming and going of May 1st without an industrial upheaval has more to do with our good or bad times than all the shoutings and scares the stock market can boast.

An idea of the amount of money the people of New York City are spending for amusement can be gleaned from figures made public by William H. Edwards, Collector of Internal Revenue, which show that the theatres of Manhattan collected $783,891.42 in war taxes during January and $695,626.70 in February. The tax on all theatre tickets is 10 per cent., so Mr. Edwards' figures indicate that the income of Manhattan theatres during January was $7,838,914.20 and the following month it totalled $6,956,267. The collector declared his office checks up all box office receipts and that the auditors have not discovered any attempt to cheat Uncle Sam.

In 1919 Ontario had fire losses of $9,500,000. These were manufacturing places, 447 fires at a loss of $2,275,000; stores, 1,008 at $1,900,000; dwellings, 5,695 at $1,650,000, and farm barns, 748 at $1,100,000. Officials say that fully half of these were from pure carelessness. We are certainly paying a fancy price for letting our ears grow long.

NORTON COMPANY OF CANADA BEGIN OPERATING AT HAMILTON

BUILDING operations on the Norton Company of Canada, situated at Hamilton, have been completed, and the management of the concern is ready to ship orders to the Canadian trade by May 15.

The plant has a complete equipment for the manufacturer of grinding wheels and the entire handling of the wheels from the mixing to shipping will be done at this new centre.

The main building is three stories high with a single floor space 50 x 100 feet and will be connected with a kiln building of two stories in back, the floor dimensions of which are 16 x 128 feet. The entire plant has a modern construction built of Hamilton pressed bricks with steel sashes throughout. It was started on November 4, 1919.

A number of expert workmen and efficiency heads from the Worcester plant are in charge of the several departments under the direction of the manager, R. C. Douglas. The personnel includes Frank Ryan, head of Methods; A. J. Mouncey, time-keeper; Albert Jornson, general foreman of Mixing, Abrasive and Bond Supply; Oscar Wahlberg, head of Shaving and Cutting; M. Anderson and Carl Forsman, in charge of Kiln; J. Hoglund, in charge of Balancing, Bushing and Truing; William Landquist, in charge of Grading, Inspection and Stock; S. H. Healey, in charge of Packing, Shipping and Traffic, and J. Jelicka, in charge of Silicate and Plastic Departments. W. H. McNeilly from the electric furnace plant, situated at Chippawa, Ontario, will take full charge of the office detail.

The Norton Company of Canada is a separate corporation, and has been capitalized at $500,000.

MR. R. C. DOUGLAS
Manager Norton Co. of Canada, Hamilton, Ont.

NEW THINGS IN MACHINE TOOLS

The Rieker Instrument Company, of Philadelphia, are placing on the market a line of precision levels for general machine shop use. Accuracy is enhanced by the special heat-treatment of the cases, a feature that prevents warping.

* * *

A machine for the twisting of flat iron bars, hot or cold, has recently been constructed by the Wallace Supplies Manufacturing Company, of Chicago, Ill. A special arrangement has been provided for offsetting the stock in such a manner as to leave the vertical edge parallel with the flat side after the twist has been made.

* * *

The Golburn Machine Tool Company, of Franklin, Pa., are now equipping their motor-driven heavy-duty drilling machines with alternating current electric control. The use of this electric control of the spindle has been in operation on these drills equipped with direct current motors, but the development of the control for use with alternating motors will increase the scope of these machines.

* * *

The O. B. Herlth Manufacturing Company, of Hartford, Conn., are making adjustable parallel sets that are claimed to be accurate to within 0.0001 of an inch. A set of these parallels comprises five adjustable blocks, ranging from 1-8 inch to 1 1-8 inch maximum thickness. They are primarily intended for the use of tool-makers, and can be used in combination with precision blocks for jig and fixture gage construction.

* * *

An improvement that provides means for controlling the length of the arc on electric arc welding apparatus, has been developed by the Electric Arc Cutting and Welding Company, of Newark, N.J. In the change that has been effected the control of the arc is in the hands of the foreman. When once the length is set it is not possible for the operator to alter the same. Provision is also made for the regulation of the voltage automatically, so that the factor of safety is a feature of its construction.

* * *

Goddard & Goddard Company, of Detroit, Mich., are now making a special inserted tooth milling cutter with the blades of high speed steel and the bodies of heat-treated alloy steel which has an elastic limit of about 105,000 pounds. The blades have multiple notches in the rear, so that when worn, they can be taken out and re-set, moving them latterly from one notch to another, thus providing long life. They are especially adapted for work of ten inches diameter and upwards.

A machine designed by Spencer Brown and manufactured by Franklin Products, Inc., of Syracuse, N.Y., provided for the mechanical rubbing down of flat and curved surfaces in paint shops and automobile plants. The machine has two feet of kickers, operating in opposite directions at each stroke, the power being supplied by compressed air. The same materials as in hand rubbing are used and the total weight of the device is about 20 pounds.

* * *

The Black & Decker Manufacturing Company, of Baltimore, are now making two sizes of portable air compressors for factory and garage use. The smaller of the two, No. 46, has a capacity of 6 cu. ft. per min., and an operating pressure of 200 pounds per sq. inch. This machine is adapted primarily for the inflation of tires direct, and will inflate a 44x 10-in. from flat to 140 pounds in 6 minutes. The other size, No. 412, is intended for the blowing out of motors and machinery, paint spraying, sand blasting, etc., and has a capacity of 12 cu. ft. of free air per min., operating at a guaranteed pressure of 75 pounds.

* * *

An interesting design of punching and bending machine has been placed on the market by the Armstrong-Blum Manufacturing Company, of Chicago, Ill. It is of structural steel construction. The legs are so mounted on the angle iron base pieces that adjustment can be made for any desired depth of throat or width of sheet within the range of the machine. The tool carrying bars, which hold the punches and dies are 40 inches long, and these tools may be placed anywhere along the bars to suit the work being done. Hand-operated eccentrics are used for operating the punches and forming dies. The machine has a capacity of 3-8 inch holes in a 3-8 inch plate.

* * *

Additions to the machine tool lines that the Alfred Herbert, Ltd. are placing on the market are the Atkins slotting machine, the Herbert hexagon turret lathe, and the Gardner crank-pin turning machine. The slotting machine has a capacity stroke of six inches and a work diameter of 30 inches. The ram is of the swivel type and the tool holder of universal clapper design. The machine has a net weight of 2,050 pounds. The turret lathes are built in three sizes, the largest taking work up to 3½ inches in diameter and 42 inches in length. Driving pulley runs on ball bearings and requires no counter-shaft. All gears run in oil and the bearings are lubricated automatically or by the continuous feed system. The Gardner crank-pin machine is designed for rapid and accurate machining of crank pins. Special chucking facilities provides for the drive through the rib next to the crank being turned, the previous turned portion being supported within the hollow spindle, thus preventing whip in the shaft. These machines are made in three sizes, with spindle bores of 16 inches, 22 inches, and 21 inches, respectively. Operating requirements call for 8, 14 and 20 horsepower.

MARKET DEVELOPMENTS

Now Feeling the Pinch of a Starved Market

Canadian Plants Find It Harder to Keep Up the Output Because Material is Uncertain—Prices for Sheets Are What Can be Secured

THE passing of May 1st without a serious disturbance in the metal working trades has been received with some satisfaction by the trade in general. A year ago developments were badly interfered with when the strikes of molders, machinists, etc., took place.

Manufacturers in several lines are facing the serious situation of not being able to get material enough to keep their plants in operation. The absence of a few parts holds back the finished article, and throws the whole system of assembling or building out of joint.

Steel mills are not doing any better in the way of delivery. There are many influences working against them, the last of which is the switchmen's strike, which has a number of shipments tied up and practically lost.

One manufacturer from Nova Scotia arrived in Toronto a day or so ago. He had been all through the warehouse district on the way up here, and was going on to Chicago to see what he could gather up in the way of black sheets. He had to have them to keep his plant going. He got only a few tons here, nothing in proportion to what he wanted. One warehouse got an offer of several hundred tons of black sheets in New York this week, the price there being 10.20. Brought here under present conditions it would mean a resale price of over 13c. The size of this price, which of course is a broker's, can be judged from the fact that at the outbreak of the war black sheets were selling at Pittsburgh mills around 2 cents per pound.

Machine tool dealers report a good inquiry in this district, but are experiencing the old trouble of very poor delivery. Some of the dealers who have just returned from the States found that makers there are sold out for weeks and months to come, and they received little encouragement of getting the Canadian allotment advanced.

The scrap metal market is dull and stagnant. Reds and yellows are not allowed to cross the border, and the market is better here for iron and steel. The wanted varieties, such as stove plate, heavy melting and cast iron, are scarce and the volume coming in is very meagre.

MAY DAY BROUGHT HARDLY ANY TROUBLE IN MONTREAL

Special to CANADIAN MACHINERY.

MONTREAL, Que., May 3rd.—While May-day brought forth its usual demonstration from certain elements in the industrial world, the celebration in this district was not of a disturbing character, and the day passed much quieter than was expected, there being considerably less interest displayed this year than last. During the past month there appeared to be a hidden influence on the activity of business which, in some quarters, was due to the possible developments in labor circles at this particular period of the year. The general quiet nature of the laboring classes here has removed the pressure to some extent and affairs have taken a turn that promises well for the season's developments. The after results of the American railroad troubles are now coming to the fore, and while the strike is virtually over, the effects are still apparent on all sides. Delivery of material is showing improvement but the inconvenience in this respect is still a retarding factor. The abnormal conditions of the past winter and the continual demand for all classes of steel, despite the high costs, has prevented the mills from keeping pace with the requirements of the trade. A feature of present activities is the comparatively heavy buying in America for export to Europe. This situation increases the difficulty of Canadian buyers in getting supplies in from the States. Dealers here are still handicapped in the matter of warehouse stocks, as surplus material can usually find a ready market, with buyers waiting to take the overflow. While conditions are expected to improve steadily from now on, it is not likely that the present month will be marked with any great advantage to the consumer on this side of the line. The recent announcement of the organization of the British Empire Steel Corporation is encouraging news to Canadians, but this venture will provide no immediate cure for existing ailments.

Normal Business in Machine Tools

There is little of exceptional interest in the present movement of machine tools. The business is quite normal with wide distribution on varied lines with no pronounced activity in any particular direction. American purchases are still affected by the exchange rate, but this factor is of less influence now than during the early part of the year. Delivery is still uncertain and used machinery maintains a prominent position in local trading. Supplies continue to move freely but difficulty is frequently experienced in locating the materials and equipment needed by the customer. Prices in all cases are well maintained.

Scrap Remains Quiet

The movement of scrap just now is not very bhisk, for the reason that many lines in constant demand are very hard to obtain, the consequences being a very strong market with few heavy sales recorded. The requirements for machinery scrap is still pressing and supplies of this character will bring record prices at the present time. It would seem that every available atom of machinery scrap has been gathered in and distributed to the foundries, as only current accumulation is now in evidence. The weekly transactions show a fluctuating market but prices on the average are much the same as last week, with non-ferrous, if anything, a little easier.

NOTHING BETTER IN DELIVERIES YET

And Some Canadian Firms Are Finding It Serious Enough to Keep Operating

ORONTO.—The fact that the first of May has come and gone, and that there has been very little trouble in this district, has made a better feeling in all circles touched by iron and steel and the other metals. Of course it can do nothing to make the supply of material any better. That is still bad—away off.

Several of the principals who are represented in Canada are looking for a change in representation in this country. One dealer, according to his own statement to CANADIAN MACHINERY, was approached and asked to take over the handling of a certain line. He replied that he did not think he could give any better service than the firm that already had the agency, as he happened to know that one of their salesmen has been pushing it steadily for some time. but could get no encouragement from the head office in the way of delivery. The firm replied again urging that the change be made. To bring things to a head the dealer wired asking if they could give prompt delivery of a number of machines. The reply came back that they would be placed in their allotment schedule, and one of the machines would be sent as far ahead as as February 8th. 1921.

The firm that wants to get into the market just now must be ready to give something like service in the way of delivery. Otherwise it does not make much difference who acts as their agents in the Canadian territory. That, at least, is the opinion of the agent who was approached to take over a line already handled here.

The Steel Market

Some of the offices here are not booking at all in steel lines. They are out of the market in everything that it means. Steel makers are finding it harder, in this country, to keep operating, especially if they are depending on United States for coal. The strike on the railways has things badly tied up for them. It is a serious matter where the operation of a battery of by-product coke ovens is concerned, as the closing of them down would mean a very serious loss. Steel making plants have been operating under heavy pressure for some time, and the finishing departments have been able in nearly all cases to keep ahead of the blast furnaces.

It is a fact that there are no prices for many of the lines that are stable in the jobbing trade. The price is simply what the material can be secured for. The market has become so drilled out that the man who holds is in a position to name his price, knowing that he can get it. Here are some of the things that one hears in the warehousing trade this week:

"We have an offer here now from a jobber in New York, who wants to know if we are interested in black sheets at 10.20 f.o.b that city. It would mean a re-sale price of between 13 and 14 cents."

"We had a stove maker in here the other day from Sackville, N.S. He had been all through the East trying to get some sheets to keep his plant in operation. He had secured little or nothing, and was working through this way, and finally on to Chicago. He got a little in Toronto, but it was only a drop in the bucket in comparison with what he wanted to keep him going."

Some of the firms throughout the country are in a bad way for want of material. Some of them face cancellation of orders because they cannot get the material to turn out the business. One jobber in Toronto got in a shipment of boiler tubes the other day. There were some three cars in the lot, and it was supposed that there would be plenty for some days. In the lot were 200 tubes of one size. The first half hour they were on the siding here, one manufacturer came in and wanted to know if they would let him have 700 of this size. So that's how long a stock lasts now.

The deliveries for material that has been railed at the mills and allotted to this district are very poor. The strike has tangled many of the lines up to a point where they do not know where cars are. It may take some days before this can be straightened out. When things do get loosened up there may be a deluge in some lines, but there is hardly a danger of any of the users getting any more than they want.

A Dull Scrap Market

Prices stay where they have been for some time. Especially for the red and yellow metals the market is dull and slow. Shipments cannot be sent to United States now, and anything that is sold has to be marketed in Canada or shipped abroad.

There is no temptation to ship iron or steel scrap to United States, under the present conditions. The market in Canada is stronger than in the States, especially for the three leading classes, stove plate, heavy melting steel and cast scrap.

There is no disposition to buy anything more than is necessary for present needs.

POINTS IN WEEK'S MARKETING NOTES

The passing of May 1 without any serious labor disturbances in Canada is regarded as a very favorable sign.

The switchmen's strike is playing havoc with many deliveries that have been expected in Canada and which are now long overdue.

Stove makers from the far-Eastern part of Canada have been in Toronto during the week trying to secure sheets. They have been through all the warehouses from here to the East, but succeeded in securing very little.

The scrap metal market in Canada is dull. Reds and yellows are not allowed across the border, and the market at home is better than in U.S. for scrap iron and steel, but the supply is very limited.

Offices in Canada of American steel mills are not booking business as a general thing. They are sold out too far ahead. Neither are they making promises as to when they will open their books.

Toronto machine tool dealers who have returned from U.S. points report that many of the big makers are sold out for months to come, and that the chances of Canadians getting more of their allotments are not very bright.

BIG STEEL MERGER NOW COMPLETED

List of Companies Given Out, to Which Others May Be Added at Later Date

MONTREAL.—The new British Empire Steel Corporation, the largest consolidation in the British Empire, and second only to the United States Steel Corporation, has now emerged from the nebulous stage into that of definite existence, as an imperial organization. Capitalized at $500,000,000, this Canadian consolidation of steel, coal and transportation company associating the iron and coal deposits of the Atlantic seaboard of the Dominion with the steel making experience and financial resources of Great Britain, is now an accomplished fact, according to Colonel W. Grant Morden,

Authoritative details as to the terms on which the three principal component parts of the British Empire Steel Corporation, Ltd., are to enter the new consolidation, subject to shareholders' approval, are as follows—Dominion Steel Corporation $95, par value in 7 per cent. non-cumulative preferred stock of the new corporation, plus $40 in common stock, to each holder of $100 of the security known marketwise as "Iron, common." Canada Steamship Lines, Ltd., $100 par value in 7 per cent. non-cumulative preferred stock, plus $45 in common, and Nova Scotia Steel and Iron Co., Ltd., $90 par value in 7 per cent. non-cumulative stock, plus $40 in common.

Details as to the terms upon which the enterprises of lesser importance are included are as yet unavailable, but will be communicated to the shareholders of each company within the next few days.

Companies Included

Included in the consolidation are the following: Dominion Steel Corporation and its subsidiaries; Nova Scotia Steel and Coal Co., Ltd., and its subsidiaries; Canada Steamship Lines, Ltd., and its subsidiaries; Canada Foundries and Forgings, Ltd., and its subsidiaries; Maritime Nail Co., and its subsidiaries; Collingwood Shipbuilding Company, Ltd.; Port Arthur Shipbuilding Company, Ltd.; Halifax Shipyards, Ltd.; Davie Shipbuilding and Repairing Company, Ltd.

To the above list may be added several other enterprises, negotiations with which are now in progress.

MORE THINGS TO INTERFERE WITH THE STEEL DELIVERIES

Special to CANADIAN MACHINERY.

PITTSBURGH, May 6.—Blast furnaces and mills are getting along decidedly better than a week or two weeks ago, as to both production and shipments. The improvement is due not so much to striking railway workmen going back to their jobs as it is due to the employment of various expedients, particularly the movement of solid trainloads of freight, and the help of an increasing number of volunteers who are helping to break the strike.

Tbe Youngstown district was affected the most by the rail strike, practically everything being closed for a time, but now about one-half the blast furnaces in the district are operating, and steel production is nearly if not quite one-half of normal. In the immediate Pittsburgh district production is but slightly curtailed, hardly by as much as 20 per cent. Shipments are reduced by a much larger percentage, but the steel at any rate has been made and some time it will go forward, probably to the embarrassment of some customers who will get too much at one time. East of Pittsburgh the furnaces and mills are operating fairly well, while there is no trouble in the south. In the Chicago district, including Gary, operations are at 50 per cent. or more of normal.

The trainload movement that has helped so much has been chiefly of coal and coke. Even single merchant blast furnaces have received coke by the trainload. The blast furnaces operating are not all running at capacity. One merchant furnace interest, for instance, which has ten furnaces scattered at various points is operating all ten, but with slack blast, so that the pig iron output is only about 75 per cent. of capacity. This procedure is regarded as better than banking furnaces entirely at intervals.

The worst feature of the rail strike is that nothing very definite, certainly nothing very vigorous, is being done to settle it. The wage commission at Washington, only set up after the strike started, is at work but there are no definite reports of its making progress.

Taking the iron and steel industry as a whole, operations are curtailed by the rail strike by not more than about 20 per cent., while shipments of finished steel are curtailed by a larger amount. Just before the rail strike the production of finished rolled steel in the United States was at the rate of fully 110,000 gross tons per working day, so that while it is literally true that hundreds of thousands of tons of finished steel are piled in mill warehouses and yards and are loaded on cars which either remain on mill sidings or have gone only a few miles to a convenient public siding, this does not mean such a great deal after all.

Consumption Curtailed

There is a great deal of curtailment in operation of factories that consume steel, arising from the rail strike. Of all materials, coal seems to be the greatest of the restrictive influences, but some factories lack other materials and not a few of course have run out of steel itself. It appears, however, that there were more consumers having a 30 days' supply, or thereabouts, of steel than was generally assumed. The automobile factories have long made it a rule to carry 30 to 60 days' stock of all their materials, but for several months past it has been impossible to follow the rule in all cases. Some stocks of steel, however, had evidently been built up. There have been various reports in the past week of the rate at which the automobile factories in Detroit were running, the reports bein of a 15 per cent. operation up to a 50 per cent. operation. There is much motor trucking of the finer forms of steel such as wire and strips, classes of steel the lack of which may hold up the consumption of much larger quantities of other descriptions of steel that may be in stock. Only a few pounds of strip steel, for instance, are required per automobile, and it is not remarkable that this material is being trucked in five-ton loads.

The Foundries

It is being pointed out that while the

THE MACHINE TOOL TRADE IS LEARNING WHAT SELLING MEANS

Never make the mistake of thinking that haberdashers and shoe merchants are the only ones who study the likes and dislikes of the dear general public. Far from it.

The footwear merchant who finds that a good line on which he can make money will not sell at $7, immediately puts them up to $12 or $14 and clears the thing with a flourish.

The same thing happens in shirts. A bit of a garment that decorates a man's carcass from the neck down to a few decimal points above the shanks may go begging for an owner at $2, while at $5 men will scramble to get inside of the thing, and manly bosoms will swell and heave in a $5 front that would have been flat as a well-flattened pancake in the same article at $2.

And so it is that the machine tool trade has caught the spirit of the thing. Profiteers? No. sir. Students of human nature and all the foolishness to which it is heir. That's all.

Well, that's simply by way of a preamble. Now for the facts. One Toronto firm of machine tool dealers had a used machine that had been taken from a good Ontario shop on a deal or something. It was overhauled and a few new parts put in where wear had shown. The mechanics in the shop where it was gone over were quite sure it would do a lot of work yet, and so the thing was listed along with a good many other tools at a very fair price. The dealer simply took the amount he had allowed, and added a figure to cover the work put on it in his shop. The trade got the list with this machine on it. But did they come around to lead it away to their premises? They did not.

The old tool simply sat on its haunches in the stock room while spiders did fancy work on it, and the dealer wondered why under the sun he had ever opened the kitchen door and let the cripple in.

Then he started to operate on the line of the shirts and the boots. All of a sudden the old tool that had been with him long enough to answer to its first name, took on a new value. The dealer wouldn't tell just how many per cents. he tacked on the price, but the supposition is that there were quite a numerous quantity of 'em.

A new list goes to the dear trade, and the old tool is on at the new price. Folks didn't want him at ten, so see if he'll be wooed and won at twenty. Say, friend, it's a fact it went with a real bang. Three or four after it, and the man who got it pleased beyond measure, and congratulating himself that he is a keen man and a real purchasing agent.

average foundry usually carries a good stock of pig iron, the foundries lately have been running into their higher-priced contracts, at above $30 or perhaps even above $35, and have been less willing to stock the higher priced iron than they were in the case of the cheaper iron. Coke has been so scarce for months that the average foundry has not been able to accumulate much stock. Thus some foundries are running out of pig iron, while others are running out of coke.

In the past few days there is an improved movement of foundry coke from the Connellsville region, but only in certain directions, chiefly east and north. There is fairly free movement from the Connellsville region clear through to Buffalo via the Pennsylvania, while the Baltimore & Ohio, in conjunction with the Buffalo, Rochester & Pittsburgh, has been running solid trainloads of furnace coke through to Buffalo. As a result of this the Buffalo furnaces are doing fairly well in the matter of operation, much better than the valley furnaces.

A fair estimate is that by this time the consumption of foundry pig iron is being curtailed by the rail strike more than is the production, there having been a gradual change in this respect, as furnaces began to operate better after feeling the first effects of the strike, while consumers have been running out of stocks of pig iron or coke.

When Connellsville coke shipments can be arranged at all, prices done are substantially the same as in the open market prevailing just before the strike, $11 to $12 for furnace coke and $12 to $13 for foundry coke, per net ton at ovens.

Quiet Markets

The pig iron and steel markets are quiet, practically stagnant, and while the condition is usually ascribed to the rail strike there is no doubt that other influences are also at work. Buyers are indisposed to make commitments for very extended delivery, particularly deliveries running over the second half of the year, while early deliveries, at least in steel products, cannot be secured except at very heavy premiums.

One little item that may be the forerunner of more important news is that some merchant bars and structural shapes have been sold by independent mills at 2.35c and 2.45c respectively, these being the Steel Corporation or Industrial Board prices. Previously all the independents were demanding higher prices, generally 2.90c to 3c for bars for delivery in a few months, and 3c to 3.10c for shapes. The sales just made were exceptional, to large buyers and for extended delivery, but there may be more of this sort of thing because of the disinclination of buyers to pay premium prices for late deliveries.

DEMAND GREAT IN THE OLD COUNTRY

And Advancing Prices Have Not Had the Effect of Keeping Down the Orders

Sheffield.—The steel trade of the country has gained enormously in strength during the past month, and, contrary to expectation, the recent drastic price advances have failed to check the expansion of buying and demand in the slightest degree. In fact, the rate of progress has been greater since that revision than before. Demand has swollen to an extent which a few years ago would not have been deemed possible. Although it has been growing rapidly since the end of last year, there is no indication that the movement is nearing its end. Unfortunately, there is no expansion of production, so that the actual turnover of the trade remains much the same, while arrears of deliveries are accumulating. A large proportion of the business offering receives no attention, simply because it is impossible to handle it. Every steel maker is assured of the disposal of the whole of his output for the present year at least, and at good prices. Large consumers would be only too ready to cover their wants until the end of the year at the current high rates, but no maker is prepared to risk the possibility of further rises in costs. The consequence is that the day of firm quotations is a thing of the past. The trader can no longer pursue the safe old custom of covering his sales with contracts for materials.

PIG IRON TRADE

The railway situation is still interfering seriously with pig iron trading. In the Pittsburgh district all efforts are bent on getting shipments through, and for the time being buying and selling are secondary considerations. The same may be said of conditions in the Chicago district, although in this case some buying has been done for second and third quarter delivery. This has been done at the price of $42 for the base grade foundry iron, Birmingham. Spot iron is bringing about $1 higher than this, Birmingham. Buffalo has to report better sales during the past week than have been made for some time, the aggregate running into nearly 15,000 tons. This includes basic, which grade made nearly half of the total, and was sold generally at $45. The base grade of foundry iron sold at $45, while a lot of malleable brought $46.25. Production is improving. Reports from New York show a strong market with demand for both domestic and export iron good. The base grade of iron at Pennsylvania furnace is now at a minimum of $46, Furnaces are not offering iron for export, fearing that they will not have enough to supply their customers in the domestic field. The situation in New England, according to Boston advices, is still limited to spot transactions, and the total sales do not reach more than 2,000 tons. Spot iron has been sold at a price which means $63 delivered.

MONTREAL NOTES

The Lachine Canal was opened for the season on May 1, when the Lady Grey passed up on her way to accelerate the breaking up of the ice at the lower entrance to the Soulanges Canal. The repairs to the Lachine Canal that have been carried on during the past month, were speeded up so that the water was turned in on the last night in April. Regular traffic is now possible on the canal.

Roy M. Wolvin, president of the Dominion Steel Corporation, will probably be the first chief executive of the new $500,000,000 British Empire Steel Corporation, now in the course of consolidation. It is expected that D. H. McDougall, president of the Nova Scotia Steel and Coal Company, will likewise be given an important position on the administration force. Plans are being formulated so that employees will participate in the success of the company and closer co-operation is hoped for. Within the course of a few years the activities are expected to be equal, or even surpass, anything of a similar character now operating throughout the world.

One of the most interesting meetings held this season at the Montreal branch of the Engineering Institute of Canada was that of the last one in April, and practically the final one of the season. The paper read and discussed was on the attainment of greater efficiency in tramway service. The subject was dealt with in a very able manner by D. E. Blair, superintendent of rolling stock of the Montreal Tramways. The speaker brought forth some very strong arguments, supported by diagrams, showing that fewer stops on existing routes would react to the betterment of present conditions and would benefit both the public and the company. A notable feature of the evening's meeting was the presentation of the Gzowski medal to Phelps Johnson and G. H. Duggan. G. F. Potter was jointly honored with one of these medals, but owing to his absence the presentation will be made at a later date. These medals are presented for the most valuable contribution to engineering literature during the year, and the committee this year decided in favor of the triple paper on "The Design, Manufacture and Erection of the Superstructure of the Quebec Bridge." Still another feature of the meeting was the presenting of gold badges as honorary members of the institute to Sir John Kennedy and Lord Shaughnessy. In expressing his thanks, Lord Shaughnessy said that during a great part of his career he had been actively associated with engineers, and had lived in an engineering atmosphere, had consulted with and taken the advice with practically every class of engineer, and while he had never been in training as an engineer, he had nevertheless learned very much from the profession.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$42 40
Lake Superior, charcoal, Chicago	57 00
Standard low phos., Philadelphia	50 00
Bessemer, Pittsburgh	43 00
Basic, Valley furnace	42 90
Toronto price:—	
Silicon, 2.25% to 2.75%	52 00
No. 2 Foundry, 1.75 to 2.25%	50 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 50
Steel bars, base, Toronto	5 50
Iron bars, base, Montreal	5 50
Steel bars, base, Montreal	5 50
Reinforcing bars, base	5 00
Steel hoops	7 00
Norway iron	11 00
Tire steel	5 75
Spring steel	10 00
Band steel, No. 10 gauge and 3-16 in. base	6 00
Chequered floor plate, 3-16 in.	9 40
Chequered floor plate, ¼ in.	9 00
Staybolt iron	9 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	4 00
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 90
Small shapes under 3"	3 62

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points	C.L.	L.C.L.
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

Gross.	Montreal	Toronto
Lake copper	$25 00	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	72 00	75 00
Spelter	12 00	12 25
Lead	11 50	12 00
Antimony	14 50	14 00
Aluminum	34 00	35 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 7 25	$ 7 25
Plates, ¼ up	6 50	6 50

PIPE—WROUGHT

Price List No. 44—April, 1920.

STANDARD BUTTWELD S/C

	Steel Black	Steel Galv.	Gen. Wrot. Iron Black	Gen. Wrot. Iron Galv.
⅛ in.	$6 50	$ 8 60	....	....
¼ in.	6 18	7 26	$ 6 43	$ 7 56
⅜ in.	5 18	7 26	5 43	7 56
½ in.	6 84	8 42	7 27	8 84
¾ in.	8 45	10 68	9 03	11 16
1 in.	12 50	15 64	13 35	16 49
1¼ in.	16 91	21 16	18 06	22 31
1½ in.	20 21	25 30	21 59	26 68
2 in.	27 20	34 04	29 05	35 89
2½ in.	43 00	53 82	....	....
3 in.	56 23	70 38	....	....
3½ in.	71 30	88 32	....	....
4 in.	84 48	104 64	....	....

STANDARD LAPWELD S/C

	Steel Black	Steel G lv.	Gen. Wrot. Iron Black	Gen. Wrot. Iron Galv.
2 in.	$30 90	$37 74	$34 60	$41 44
2½ in.	45 34	56 16	51 19	62 01
3 in.	59 29	73 44	66 94	81 09
8½ in.	73 14	90 16	82 34	99 36
4 in.	86 66	106 82	97 56	117 72
4½ in.	0 98	1 23	1 24	1 49
5 in.	1 15	1 44	1 44	1 73
6½ in.	1 49	1 86	1 87	2 25
7 in.	1 94	2 43	2 42	2 90
8-L in.	2 04	2 55	2 54	3 05
8 in.	2 35	2 94	2 92	3 51
9 in.	2 81	3 52	3 50	4 21
10-L in.	2 61	3 26	3 25	3 90
10 in.	3 36	4 20	4 18	5 03

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.

4½" and larger 50%.

4" and under, running thread, 30%.

Standard couplings, 4-in. and under, 30%

Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices.

Per 100 Pounds.	Montreal	Toronto
Copper, light	$15 00	$14 00
Copper, crucible	18 00	18 00
Copper, heavy	18 00	18 00
Copper wire	18 00	18 00
No. 1 machine composition	16 00	17 00
New brass cuttings	11 00	11 75
Red brass cuttings	14 00	15 75
Yellow brass turnings	8 50	9 50
Light brass	6 50	7 00
Medium brass	8 00	7 75
Scrap zinc	6 50	6 00
Heavy lead	7 00	7 75
Tea lead	4 50	5 00
Aluminum	19 00	20 00
	Per Ton	**Gross**
Heavy melting steel	18 00	18 00
Boiler plate	15 50	15 00
Axles (wrought iron)	22 00	20 00
Rails (scrap)	18 00	18 00
Malleable scrap	25 00	25 00
No. 1 machine east iron	32 00	33 00
Pipe, wrought	12 00	12 00
Car wheel	26 00	26 00
Steel axles	22 00	20 00
Mach. shop turnings	11 00	11 00
Stove plate	26 50	25 00
Cast boring	12 00	12 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜-in. and less	10
Carriage bolts, 7-16 and up	Net
Coach and lag screws	25
Stove bolts	55
Wrought washers	45
Elevator bolts	Net
Machine bolts, 7/16 and over	Net
Machine bolts, ⅜-in. and less	15
Blank bolts	Net
Bolt ends	Net
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square, blank ... add	$2 00
Nuts, square, tapped ... add	2 25
Nuts, hex., blank ... add	2 25
Nuts, hex., tapped ... add	2 50
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws ... 25 and	5
Sq. and hex. hd. cap screws	22½
Rd. and fil. hd. cap screws ... plus	17½
Flat but. hd. cap screws ... plus	30
Fin. and semi-fin. nuts up to 1-in.	20
Fin. and Semi-fin. nuts, over 1 in., up to 1½-in.	10
Fin. and Semi-fin. nuts over 1½ in., up to 2-in.	Net
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws ... list plus 20,	30
Thumb screws	40
Thumb nuts	75
Patch bolts ... add	20
Cold pressed nuts to 1½ in. ... add	$1 00
Cold pressed nuts over 1½ in. ... add	2 00

BILLETS

	Per gross ton
Bessemer billets	$60 00
Open-hearth billets	60 00
O.H. sheet bars	76 00
Forging billets	56 00-75 00
Wire rods	52 00-70 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 70
Cut nails	5 85
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 35½
British Manila rope	0 28
New Zealand hemp	0 28
Transmission rope, Manila	0 47
Cotton rope, ¼-in. and up	0 88

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net

MISCELLANEOUS

Solder, strictly	$ 0 40
Solder, guaranteed	0 43
Babbitt metals	18 to 70
Soldering coppers, lb.	0 62
Lead wool, per lb.	0 16
Putty, 100-lb. drums	8 30
White lead, pure, cwt.	20 00
Red dry lead, 100-lb. kegs, per cwt.	16 50
Glue, English	0 40
Tarred slater's paper, roll	1 30
Gasoline, per gal., bulk	0 35
Benzine, per gal., bulk	0 35
Pure turp., single bbls., gal.	3 60
Linseed oil, raw, single bbls.	3 00
Linseed oil, boiled, single bbls.	3 03
Sandpaper, B. & A.	List plus 43
Emery cloth	List plus 37½
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin, "D," per lb.	0 14
Borax crystal and granular	0 14
Wood alcohol, per gal.	2 70
Whiting, plain, per 100 lbs.	2 75

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes	32½
Can. carbon cutters, plus	20
Standard drills, all sizes	32½
3-fluted drills, plus	10
Jobbers' and letter sizes	32½
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	net
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus 20 to	40
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At warehouse]

Rounds and squares	$7 base
Hexagons and flats	$7.75 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	60	75
Class B	27	37
Class C	18	27

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 8 50	$ 9 50
Sheets, black, No. 10	8 50	9 00
Canada plates, dull, 52 sheets	8 50	10 00
Can. plates, all bright	8 60	9 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	11 00	....
Fleur-de-Lis, 28 B.W.G.	10 50	....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28	....	....
Premier, No. 28, U.S.	11 50	10 50
Premier, 10¾-oz.	11 50	10 90
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅝ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	29 50
1¾ in.	31 50	30 00
2 in.	30 00	30 00
2¼ in.	35 00	29 00
2½ in.	42 00	37 00
3 in.	50 00	48 00
3¼ in.	.. ..	48 50
3½ in.	63 00	51 50
4 in.	85 00	65 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	24½
Palacine	27½
Machine oil, per gal.	43½
Black oil, per gal.	18½
Cylinder oil, Capital	82
Cylinder oil, Acme	70
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	$2 60
Union thread cutting oil, antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil, bbls., net	13½

BELTING—No 1 OAK TANNED

Extra heavy, single and double	10%
Standard	10%
Cut leather lacing, No. 1	2 75
Leather in side	2 40

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 60
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	09
Pumice, ground	06
Emery glue	30
Tripoli composition	09
Crocus composition	12
Emery composition	10
Rouge, silver	60
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE

XXX Extra	.24	Atlas	.20
Peerless	.22½	X Empire	.19½
Grand	.22½	Ideal	.19
Superior	.22½	X Press	.17½
X L C R	.21		

Colored

Lion	.17	Popular	.13
Standard	.15	Keen	.11
No. 1	.15		

Wool Packing

Arrow	.35	Anvil	.22
Axle	.28	Anchor	.17

Washed Wipers

Select White	.20	Dark colored	.09
Mixed colored	.10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades... 15%

ANODES

Nickel	.58 to .65
Copper	.38 to .45
Tin	.70 to .70
Zinc	.18 to .18

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10.		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6 x 4 base	45 00	44 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 75	$14 50
Sheets, 3½ lbs. sq. ft.	10 50	14 00
Sheets, 4 to 6 lbs. sq. ft.	10 25	13 50

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .23
Acid, hydrochloric	.03¼
Acid, nitric	.10
Acid, sulphuric	.03¼
Ammonia, aqua	.15
Ammonium, carbonate	.20
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, annhy.	.41
Copper, sulphate	.16
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.08
Nickel carbonate	.32
Nickel sulphate	.19
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.25
Silver nitrate (per oz.)	1.20
Sodium bisulphate	.11
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.18
Tin chloride	1.00
Zinc chloride, C.P.	.30
Xinc sulphate	.08

Prices per lb. unless otherwise stated

British Firms Should Study Canadian Field

Big Mistake to Take Too Much for Granted—The Customs Regulations and the Preferences of the Trade Here Should Also be Consulted by the British Makers

THE Canadian Association of British Manufacturers and their representatives, since their organization in Canada, and particularly since their affiliation with the Federation of British Industries, a world-wide organization, have become more and more a factor in assisting trade between Britain and Canada. British firms wanting representatives in this country are depending largely on the advice of this society, and British firms having inquiries for material from various parts of the world are sending many of them to Canada to see what can be done here in the way of looking after the business. So it will be seen that the organization works both ways, helping British trade to get on the Canadian market, and helping Canadian firms that have material or goods for sale to place them to advantage.

Mr. George A. Marshall, president of the Canadian Association of British Manufacturers, and also a member of the Supreme Council of the Association, discussed the problem of marketing British goods in Canada with a representative of CANADIAN MACHINERY. Mr. Marshall has been in the importing business here for some years, and is in a position to have seen mistakes that have been made, and also to offer to the British manufacturer who has not yet cultivated the Canadian market some worth-while advice.

About Representation

"What would you consider," inquired CANADIAN MACHINERY, "the most desirable method for a British firm to try and get established in the Canadian field?"

"In the first place, the British manufacturer should seek to understand the Canadian market. He should not take too much for granted, as it is very easy to go wrong at the start from this cause. It is this way — a Canadian understands the territory and the conditions of trade here, but may not understand the British lines, while a man from the Old Country house will have a good knowledge of the lines but no knowledge of the territory and what it wants. It seems to me that it is easier to get a man who knows the territory to become familiar with the lines. Large British firms should seek to establish their own branches here. Roughly speaking, I should say there are three points from which to work in Canada, and of these I would put Montreal first, Toronto second, and Winnipeg third. Remember, I am speaking of the lines in which I am interested, the steel, machinery and metals. Montreal is the point for steel and heavy lines, but I believe Toronto is the best commercial city in the country. Montreal has the advantage in the way of having the ocean liners coming up there a good part of the year, and this cannot be overlooked. Of course, a manufacturer would have to judge his locations by the lines he has to sell. He might want to cater to Western trade entirely, and to do that Winnipeg to my mind is the point."

Stocks or Samples

Speaking of stocks here, samples and catalogues, Mr. Marshall continued: "The placing of a new line before the Canadian trade is a big problem, as the territory is large and would take a long time to cover. Some people seem to have the idea that they can do it all by catalogues and circulars. They cannot. As far as possible I would advise that the representative seek to personally know his customers or prospects. The British manufacturer should seek to select in the first place a paper that specializes in his line, and I consider that one of the best ways of reaching the people he is desirous of influencing. Successful advertising is a combination of all the forces that can be brought to bear on the field. British manufacturers would be well advised to send goods out to their agents here on consignment. Of course the average British firm would say to-day that they cannot send out material on consignment, but I am speaking of the cultivation of the Canadian field by a British firm for years to come."

Financing the Business

"Anything in the matter of financing the business that the British firms should know?"

"There should be a change made in the system of cash against shipping documents," replied Mr. Marshall. "I don't suppose it will be necessary to reassure the British firms that Canada is good pay and that they will have little or no trouble in the matter of securing their money. They should adopt the same system that the Canadian uses when he is sending material to Britain. He does not demand cash against shipping documents, but on receipt of goods. The Canadian trade has come more to that system of dealing since the outbreak of the war. People here like to see what they are getting before they are asked to pay for it, and it is only proper that such should be the case.

Should Remedy This Matter

"Apparently there are many British firms sending material to Canada who have not yet learned to follow the customs regulations of this country, and there is an endless amount of trouble as a result. I wish you would make it very clear to the British exporter to Canada that he must send along properly certified triplicate invoices. Now, get that plain — triplicate invoices—properly certified. It is hardly likely that British firms understand the trouble, inconvenience and loss of time that disregard of this simple rule causes to the firms in this country that are trying to get their goods delivered on anything like proper schedule. This refers to samples or bulk, and there is no exception to it. Here is one instance of many I have heard that shows the trouble one gets into. At Christmas we had a quantity of cutlery coming in. The triplicate invoices were not forwarded, and we had to pay a sight entry to get the goods out so as not to disappoint our customers in the matter of seasonable delivery. The duty amounted to $300, and we had to pay $851 in order to get the shipment released. When the papers finally arrived we applied for and secured a rebate, but all the same it makes a lot of annoying worry and accomplishes nothing.

"The British manufacturer should also consider his Canadian distributor in the matter of giving him all the assistance possible in the way of publicity. On the literature he sends out from the home office, and in all advertising matter, he should always give particulars and address of the firm in Canada handling the line. Too often this is neglected. There is business to be secured from an adherence to this plan.

Should Study Canada

"The British manufacturer," remarked Mr. Marshall in conclusion, "has a real chance now to show that he is interested in the Canadian field. One way would be by giving some service in the matter of delivery. There should be more elasticity in the making of lines to meet the needs of the trade here. British firms should bear in mind that Canadians have bought largely of American machine tools, and are accustomed to them. All these things can best be learned by a study of the field here, and by observing the advertising pages of the specialized papers. By all means let the Britisher, wherever possible, know and study Canadian industrial conditions. He can hardly secure too much information. You know we are looking forward to seeing Canada a great country. The British manufacturer should not come in here for the business he can pick up this year or next year, but should look at it from a standpoint of permanency. In short, let him study the requirements, use the papers that specialize in his lines, observe the regulations necessary to get prompt delivery, take a sympathetic attitude to the Canadian view of payments, and give his best service in the matter of shipment. There is a lot of business in Canada, and there is no reason why the British manufacturer should not secure a good share of it."

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LeBLOND
HEAVY DUTY
Universal Millers

Are not only Tool Room Machines, but as a manufacturing proposition appeal to the careful buyer.

Their long life insures ample returns for the investment made.

May we explain to you their many advantages and the convenience of their control.

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The A. R. Williams Machinery Co.
LIMITED
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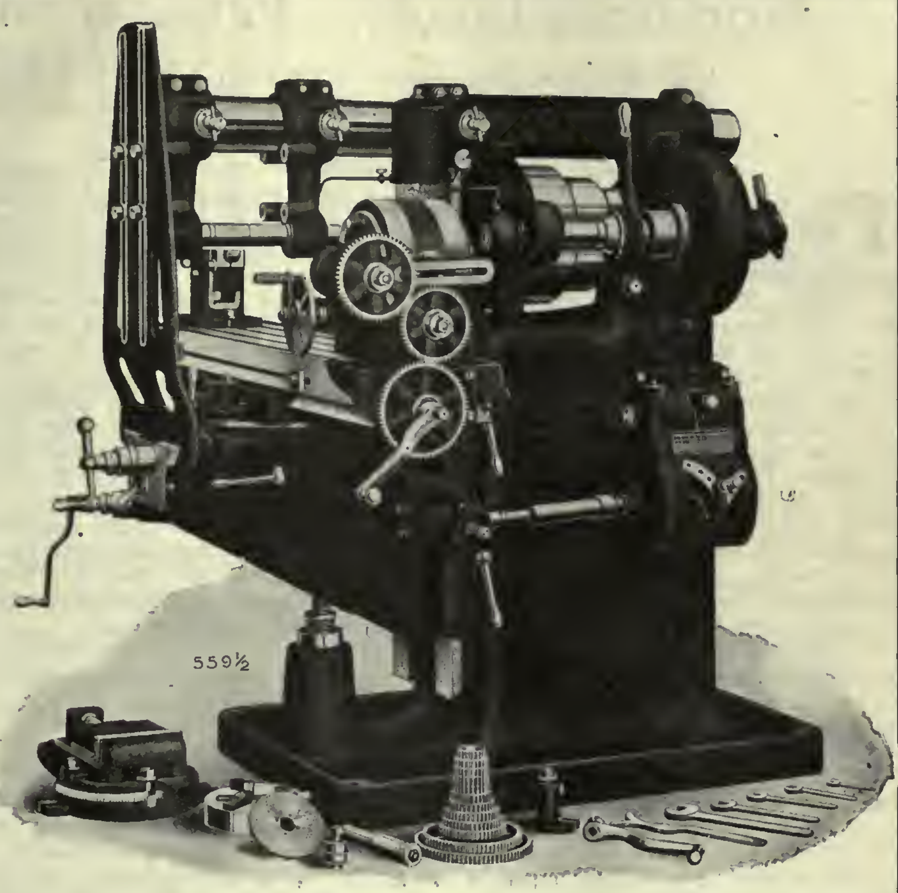
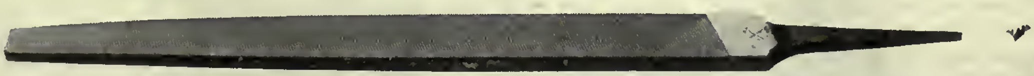




P✕H

IMPERIAL

INGERSOLL

Northern Electric Pension and Benefit Plan

The Matter Has Been Gone Into Very Carefully and Firm is Able to Announce Exactly What It Can Do in the Way of Pensions or Sick Benefits

THE Northern Electric Co., Montreal, have announced the inauguration of a comprehensive pension and benefit plan. They have set aside the sum of $150,000, and the manner in which the fund is sustained is set forth in a letter to the employees from Mr. P. F. Sise, president of the company.

To the Employees:

At the regular meeting of the Board of Directors of the company, held on December 17th, 1919, authority was granted for the establishment of a plan for an Employees' Pension and Benefit Fund for the granting of pensions and benefits to the employees of the company, to take effect on and after the first day of April, 1920.

The sum of one hundred and fifty thousand dollars ($150,000), has been placed to the credit of the fund, and it is the intention of the Board to credit to the fund interest at the rate of four per cent. per annum on the unexpended balance, and also at the end of each year to make such additional appropriation as is required to restore the fund to its original amount, provided that such additional appropriation shall in no year exceed two per cent. of the company's payroll.

The provisions of the plan do not call for any contribution by the employees, the whole cost being borne by the company. The purpose which the directors have in view is not only to recognize the loyalty and devotion of the employees, but to offer greater protection to them when overtaken by illness, accident or infirmity.

The following is a summary of the provisions of the plan which require mention.

P. F. SISE,
President.

Montreal,
January 2nd, 1920.

The general outline of the plan is given as follows:

1. Committee

A Committee consisting of:
The General Superintendent
The Secretary
The General Sales Manager
The Chief Engineer
The Chief Accountant

has been appointed, called the "The Employees' Benefit Fund Committee," with general authority to administer the "Employees' Pension and Benefit Fund," and to decide all questions relating to the plan and the carrying out thereof.

2. Pensions

2. 1.—The plan provides the following as pensions for employees who are retired and who come under the classes listed below. Employees in class A may be retired on pension, either at their own request or at the discretion of the Committee. Employees in Classes B and C may be retired on pension only at the discretion of the Committee and with the approval of the president or vice-president.

2. 2.—Class A.—A male employee whose age is sixty years or more (female fifty-five or more), and whose term of employment has been twenty years or more.

2. 3.—Class B.—A male employee age is fifty-five but less than sixty years (female fifty, but less than fifty-five), and whose term of employment has been twenty-five years or more.

2. 4.—Class C.—A male employee whose age is less than fifty-five years (female less than fifty) and whose term of employment has been thirty years or more.

2. 5. Class D (Disability Pensions).—An employee whose term of employment has been fifteen years or more and who becomes totally disabled by reason of sickness or of injury other than by accidental injury arising out of and in the course of employment by the company, may, at the discretion of the Committee, and with the approval of the president or vice-president, be granted a disability pension, which shall continue for such period only as the Committee may decide.

2. 6.—The annual pension in any of the above cases shall be one per centum (1%) of the average annual pay based on the average annual pay of the ten consecutive years of service during which the retiring employee was paid the highest annual pay, multiplied by the number of years in the employee's "Term of Employment."

2. 7.—For example: An employee whose term of employment at the time of retirement has been 30 years, and whose average pay for 10 years has been $1,500 a year, will receive an annual pension equal to 30% of $1,500 or $450.00 payable in monthly amounts of $37.50.

2. 8.—The minimum pension will be twenty dollars ($20), but this is not to apply to disability pensions granted to employees of less than twenty years' service.

2. 9.—Pensions granted to employees retired on account of age or length of service shall continue from date of retirement to death of pensioner, except as otherwise provided.

2. 10.—Regular employment under a salary with this company shall suspend the pension payments to a retired employee during the period he continues in such employment.

3. Accident Disability Benefits

3. 1.—The plan p rovides the following as Accident Disability Benefits on accoun of physical disability to work by reason of accidental injury arising out of and in the course of employment by the company.

3. 11.—Total Disability Benefits.—Full pay for first thirteen weeks, half pay for remainder of disability. Maximum benefits not to exceed twenty dollars ($20) a week after six years of such payments.

3. 12.—Partial Disability Benefits.—100% of loss in earning capacity for first thirteen weeks; 50% of loss in earning capacity for the remainder of payments not to exceed six years.

Sickness Disability Benefits

4. 1.—The plan provides the following as Sickness Disability Benefits, the sickness includes injury other than accidental injury arising out of and in the course of employment by the company.

4. 2.—These benefits begin on the eighth calendar day of absence on account of sickness, and are as follows:

Term of Employment (Years)	Full Pay (Weeks)	Half Pay (Weeks)
2 but less than 3	4	9
2 " " " 4	5	13
4 " " " 5	6	17
5 " " " 6	7	21
6 " " " 7	8	25
7 " " " 8	9	29
8 " " " 9	10	33
9 " " " 10	11	37
10 and over	13	39

4. 3.—Benefits are not allowed for sickness of employees for less than two years' service, nor for the first seven days absence on account of sickness. In such cases, such practice as the company may establish from time to time will be followed.

5. Death Benefits

5. 1.—The plan provides the following as Death Benefits: In case of an employee's death by either accident of sickness, death benefits shall be paid only to the dependent's wife (or husband) or wholly dependent relatives of the employee, and provided, however, that a husband, son or male relative of eighteen years of age or over shall not be entitled to receive death benefits even though dependent upon the deceased employee for support at the time of the employee's death, unless he is physically or mentally incapacitated from earning a living.

5. 2.—Sickness Death Benefits.

5. 2.—Sickness to include other than aaccidental injury arising out of and in the course of employment by the company.

5. 22.—If the employee's term of em-

GEOMETRIC
Adjustable Collapsing Taps

Have overcome all the expense and annoyance of tapping screw threads with a solid tap.

Anyone doing thread tapping knows what backing out a solid tap each time means. It usually means low production, poor threads, and worn out taps.

The mechanism of the Geometric Taps takes care of adjustment to correct diameter each time a thread is tapped, it collapses the chasers automatically, leaving a thread clean cut and perfect.

The chasers are readily reground, and when finally used up, are renewed at comparatively small cost, leaving the tap as efficient as when new.

The manufacturers of the Geometric line of Collapsing Taps and Self-opening Die Heads are justly proud of the distinction which is theirs:—

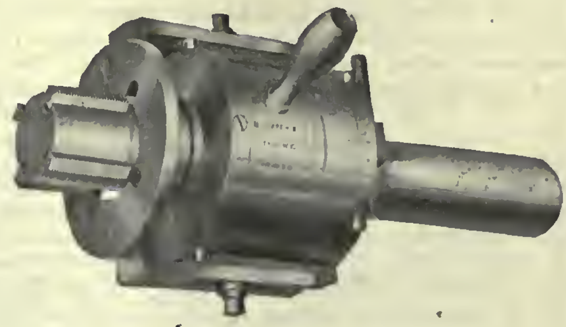
The Originators
and the
Largest and Best Known Manufacturers
of
Automatic Threading Tools

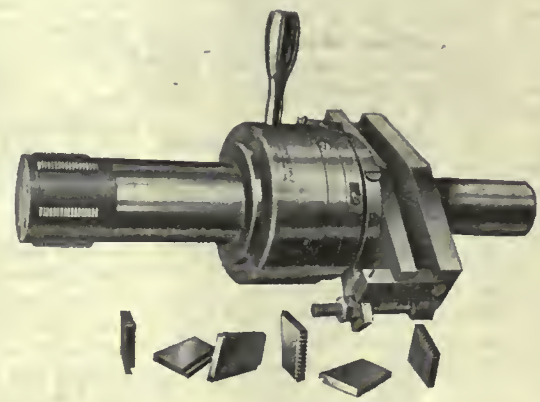
For cutting all classes of screw threads, internal and external, of any diameter and form.

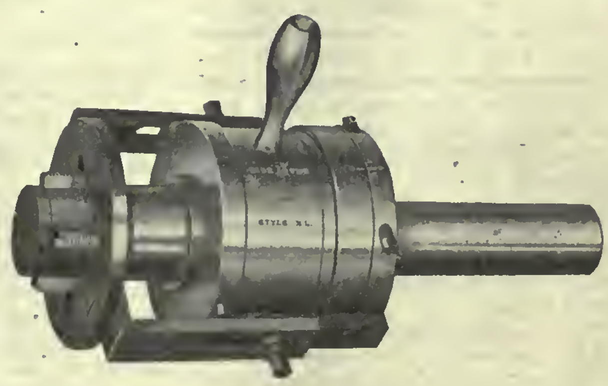
The Geometric Tool Company
New Haven, Conn., U.S.A.

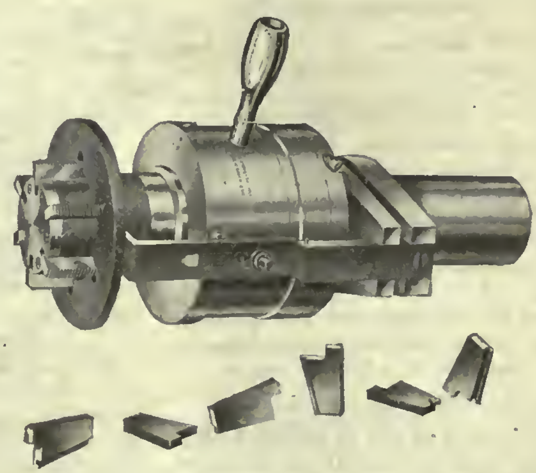
CANADIAN AGENTS:

Williams & Wilson, Ltd., Montreal; The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg and St. John, N.B.; Canadian Fairbanks-Morse Co., Ltd., Manitoba, Saskatchewan, Alberta.









ployment has been ten years or more: One year's pay, not to exceed two thousand dollars ($2,000).

5. 23.—If the employee's term of employment has been five years or more, but less thann ten years: Six months' pay not to exceed two thousand dollars $2,-000).

5. 3.—Accidental Death Benefits.

Resulting from injuries arising out if and in the course of employment by the company.

5. 31.—Three years' pay, not to exceed five thousand dollars ($5,000), and the necessary expenses for burial, not to exceed one hundred and fifty dollars ($150).

6. Pay

6. 1.—The term "Pay" for pensions and death benefits shall be understood to mean the total earnings of the employee.

6. 2.—The term "Pay" for sickness and Accident Disability Benefits shall be understood to mean:

6. 21.—For monthly and weekly rated employees, the monthly or weekly rate the employee was receiving at the time the disability began.

6. 22.—For hourly rated employees, the average earnings of the employee for the previous thirteen weeks, or such shorter period as the employee has been in the company's services previous to the week of absence on acount of disability.

Notification of Disability or Death

7. 1.—Every employee who shall be absent from duty on account of sickness or injury must at once notify his immediate superior and the employee shall not be entitled to benefits for time previous to such notice, unless delay shall be shown to have been unavoidable and satisfactory evidence of disability is furnished.

7. 2.—All claims for death benefits must be made in writing within one year from the date of the death on which the claim is based.

7. 3.—All claims for disability benefits must be made within sixty days from the date of accident or from the first day of absence on acount of sickness.

8. Retirement Age

8. 1.—The plan provides that employees who become seventy years of age, shall retire from the employment of the company at the end of the month in which they reach that age, provided, however, that if such employees' usefulness is unimpaired and their superior makes request, the Employees' Benefit Fund Committee may recommend the continuance of such employees in the service, and if its recommendation is endorsed by the president or vice-president, the Board may suspend the operation of this rule in individual cases.

9. Employees' Service Record

9. 1.—A copy of this pamphlet will be given to each permanent employee at present in the service of the company, and to each such employee on entering its service hereafter. The employee shall furnish for the files of the Committee, on "Employees' Service Record" form supplied for that purpose, information regarding his age, previous service, and the name of beneficiary in case of death.

9. 2.—The employee shall advise the secretary, Employees' Benefit Fund Committee, of any changes in the information furnished on the "Employees' Service Record form, referred to in the above paragraph. The employee can obtain from his immediate superior the form which is to be used in submitting further information.

9. 3.—The expression "Term of Employment" shall mean the period of continuous employment in the service of the company. The period of continuous employment shall not be considered as interrupted on account of temporary layoff, except as otherwise provided.

9. 4.— "Temporary Lay-off" on account of reduction of force shall not be considered as a break in the continuity of service, but when the period of absence from such cause exceeds six months in any twelve consecutive months, the entire period of absence shall be deducted in computing "Term of Employment," and all subsequent periods of temporary lay-off shall be deducted until the employee shall have been continuously engaged in the performance of duty for a period of twelve consecutive months.

9. 5.—Continuity of service shall be deemed to have been broken when:

Term of Employment	If temporary lay off before re-engagement exceeds
Less than one year	Three months
One year or more but less than two	Six months
Two years or more but less than five	One year
Five years or more	Two years

9. 6.—Leave of absence without pay for any period in excess of one month shall not be effective unless approved in writing by the Committee, and in any case in which such approval is given the Committee will indicate whether or not the period of absence is to be deducted in computing term of employment, and whether during the absence the employee shall be eligible to benefits under these regulations.

9. 7.—Military Service, 1914-1919.— All former employees who left the employ of the company for military service and who returned to our employ previous to January 1st, 1920, shall receive credit for the total period of their military service when calculating their term of employment.

10. Restrictions of the Plan

10. 1.—In case of disability or death directly or indirectly due to intoxication or to the use of alcoholic liquor as a beverage, or the use of stimulants or narcotics or to unlawful acts or immoralities, or to fighting, unless in self-defence against unprovoked assaults, or to other encounters, such as wrestling or scuffling, or to injury received in any brawl or in any liquor saloon, gambling house or other disreputable resort, or to the wilful intent of the employee to injure himself or another, or to veneral diseases, no right to benefit under these regulations shall exist except at the discretion of the Committee.

10. 2.—Death or disability resulting from infection of a cut, abrasion, scratch, puncture or other wound not immediately disabling and not reported at the time of the occurrence causing the injury, shall not be classed as due to accident, except at the discretion of the Committee.

10. 3.—Pensions or disability benefits may be suspended or terminated in the discretion of the Committee, in cases of gross misconduct or of any conduct prejudicial to the interests of the company.

11. Company's Legal Obligations

Nothing contained in the plan shall create expressly or by implication or inference any contract or contractual relation nor obligation between the company and any emplowee or the legal representatives of independents of any employee. The pensions and allowances heretofore granted, or which hereaftefir heretofore granted to any such employee, representative or dependent, shall be deemed alimentary and for personal use, and shall not be assigned or otherwise alienated, and shall not confer upon any employee, representative, dependent or any other person, any right or interest capable of being assigned or otherwise alienated, or of being seized, attached, garnished, or otherwise made subject to any process or proceeding in law or in equity.

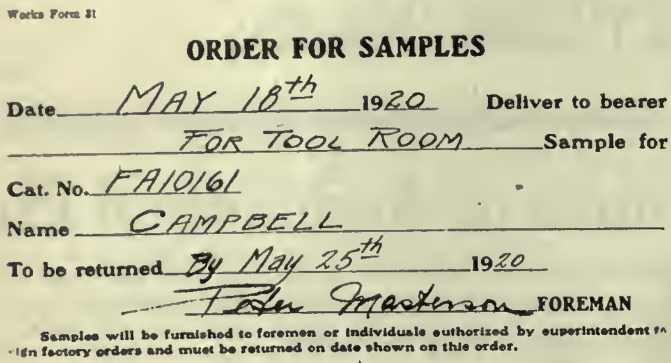
12. Where Allowance or Compensation is Payable Under Any Law.

12. 1.—In case any allowance or compensation account of injury or sickness or death shall be payable by the company under Federal or Provincial laws now in force or hereafter enacted, to any employee of the company, or his relatives, dependents, executors or administrators, or other representatives under such laws, the excess only, if any, of the amount provided for herein above the amount of such allowance or compensation prescribed by law shall be the amount of benefits which may be payable hereunder, and in cases where the benefits are payable weekly, monthly or by other instalments, the decision of the Committee, approved by the president or vice-president, as to whether there is, or will be any excess, and the amount thereof, shall be final.

12. 2.—Should any claim be presented or suit brought against the company for damages an account of injury, sickness or death of an employee, nothing shall be payable hereunder on account of such injury, sickness or death, provided, however, that the Committee may, in its discretion, and upon such terms as it may prescribe, waive this provision if such claims be withdrawn and if such suits be discontinued.

date on which the request is made, the department to which the sample is going, and the foreman's name who authorized the getting of the sample.

In this way, the attendant has a definite record of the price he is about to


Works Form 31

ORDER FOR SAMPLES

Date MAY 18th 1920 Deliver to bearer

FOR TOOL ROOM Sample for

Cat. No. FA10161

Name CAMPBELL

To be returned By May 25th 1920

Peter Masterson FOREMAN

Samples will be furnished to foremen or individuals authorized by superintendent to sign factory orders and must be returned on date shown on this order.

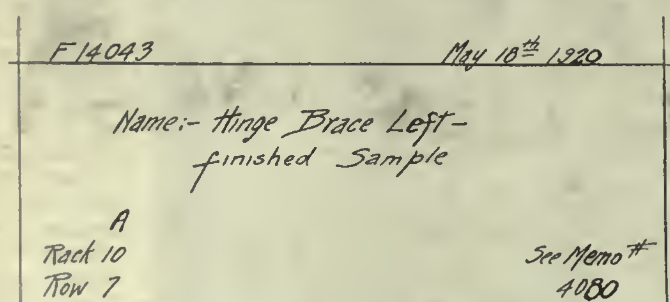
FIG. 3—SHOWING THE FORM OF ORDER SLIP USED AS REQUEST FOR SAMPLES.

hand out. He goes to his files, locates the position of sample, goes to the rack and secures it, all in about a minute. On handing out the sample, he takes this slip and places it in a special pigeon-holed shelf, which is arranged both alphabetically, and daily. That is, the racks are marked A, B, C, etc., also Monday, Tuesday, Wednesday and so on.

No sample is allowed to be out more than a week without a new slip being issued. This arrangement guards against careless workmen not returning samples promptly. On sample being returned, the worker receives his slip back, and promptly destroys it.

To make the system clearer, we will take our example over again from the point where the sample was requested. On going to the rack, the attendant finds that the sample is gone. On discovering this fact, he can, as a general rule, remember who receives it, and going to the proper pigeon hole produces the slip as proof. He instructs the workman where sample is located, and off he goes to find if he can have it.

Suppose it is in the tool room. On going there he requests the loan of the sample, but has first to give the work-


F14043 May 18th 1920

Name:- Hinge Brace Left-
finished Sample

A
Rack 10
Row 7

See Memo #
4080

FIG. 1—A SAMPLE CARD AS KEPT IN THE ATTENDANT'S FILE.

man who has the sample a slip to say he received it from him. Nothing is left to chance. A[illegible]sibility is placed where it belongs, and track is kept every moment on the movement of the sample.

Samples Overdue

Now comes the need of the assistant for a few hours. At the end of each week, there is usually an assortment of slips in the pigeon-holed shelf, of samples which have not been returned within the limit of time allowed. Leaving the assistant in charge of the store room, the attendant goes forth armed with these slips as evidence, and traces the overdue samples. If the samples are desired for a further length of time, a new slip is made out with the changed date. Should the owner of the slip admit that he has lost track of the sample, the experimental department is notified, when they send out a tracer to investigate the situation.

A sample is never considered lost before a three-month limit, but in extreme cases a sample does mysteriously disappear, which proves that no matter how well a system may be developed, certain allowances must be made for unforeseen circumstances. After three months, a new sample is issued if the search has proved to be unsuccessful.

We would not infer from the above that many samples are lost, for such would be a reflection on this splendid system, but we do want to be fair and point out that leaks will happen even in the best of conducted systems.

To any concern handling a large number of parts, we can safely recommend the adoption of this system, for the writer personally has seen this arrangement working very smoothly under the most adverse of conditions.

The production of molybdenite in the Province of Quebec for 1918 amounted to 342,296 lbs., which was valued at 383,252 dollars. This output is an increase of 51 per cent. in quantity and 61 per cent. in value, as compared with the previous year.

COTTON ROPES FOR BELTS

According to Mr. J. Melville Allison, an English engineer, who spoke before the Montreal branch of the Canadian Engineering Institute, British manufacturers use cotton rope for belting purpose to a greater extent than we do on this side of the water.

His address was illustrated by special slides showing various types of cotton rope used for power transmission and the methods of using it.

Mr. Allison said that in England they had paid much more attention to rope, draw for power transmission than on this continent. Cotton, he said, had superseded manila and any other material for rope drive in this connection. While some attention had been given to this method of power transmission on this side, manufacturers had not kept pace with the work in England, where cotton rope for drives was largely in use, some installations having been operated for twenty years. Manila rope, he said, was cheaper than cotton, but the latter would carry a third more power, with a lifetime in the ratio of five to one. while the cotton rope was much less affected by atmospheric conditions.

Splicing cotton ropes for power purposes, said Mr. Allison, was so important a feature of this work that English experts in splicing had been sent to all parts of the world. In textile plants the cotton rope drive had been found superior to the leather belting, as less cumbersome, cheaper, and that it let in much more light than the heavy leather belts.

DE-MAGNETIZING A WATCH

In working around an old-type bipolar generator having an extremely large magnetic leakage, a writer in an American contemporary states that his stop-watch become magnetized so that when he snapped the watch to start, the resetting lever dragged the cam to its point before releasing, thus moving the hand from 0 to 30 sec. in a small fraction of a second, before the wheel engaged with the watch mechanism. To de-magnetize it, he took a coil about 5 in. in diameter, consisting of 600 turns of No. 30 B. and S. gauge magnet wire, and connected it to 110-volt 60-cycle circuit. Then tying the watch to a piece of string and twisting it so that it would spin around, he passed it through the coil with the watch spinning rapidly. He adds that there was not a trace of permanent magnetism left in the watch after performing this operation once.

FRANCE

The Societe des Charbons L.T.H. is about to construct at Lariche, near Tours, factory for the production of coal from lignite and peat by the Teissier process. Touraine possesses a certain number of peat deposits, of which the most important is that of Saint-Paterns, on the line from Tours to Le Mans. This means that the new enterprise will consequently be able to obtain its raw material almost at the door of the factory.

Talk on Modern Methods of Heat-Treatment

This Paper, Which Was Presented Before the Philadelphia Chapter of the American Steel Treaters' Society, Describes in a Practical Manner Different Methods Adopted in the Art of Heat Treatment

By JOHN E. HALBING* and FRANK SHEPHERD†

IN the designing and manufacturing of machines and tools to-day, heat treatment has become such an important factor that without it engineers would be hopelessly lost, manufacturing or machine departments could not hope to meet the demands for production and the finished product in nine cases out of ten would be of very little commercial value.

The age demands that engineers design lighter and sometimes more complicated machines and tools which must perform more efficiently than former ones; manufacturing departments must be speeded up so as to increase production; it demands that the steel manufacturers experiment with and produce new steels that are capable of yielding the properties demanded by the engineers and manufacturing departments, and then, while we might go on indefinitely naming the demands made upon everybody, it is up to the heat treater to see to it that all the engineer's trouble in designing the new machine, all the efforts which the machine department had put forth in making new tools, fixtures, etc., and all the endless trials which everybody, including the steel maker, had to contend with up to the point where the machine parts were ready for heat-treating, not counting the costliness of all these things are not all wasted energy and money.

Without a doubt the national crisis through which we have just passed, with its demands for aeroplanes, trucks, better guns and shells and more of them, has been more instrumental in gaining for heat-treating the industrial prominence which it holds to-day than any other thing.

In the manufacture of mining machinery, as in the automobile or munition industries and countless others, where parts are made which later in service are subjected to severe stresses, the part which heat-treatment plays is an all important one.

Some hammer drills, for instance, weighing in all only 100 lbs., striking 1,500 blows per minute with a hammer weighing 8 lbs., upon a rock drill steel with a 1⅜ inch bit, which drills eleven inches per minute in hard granite, are subjected to very severe impact and vibratory as well as torsional stresses.

Anyone, even those not familiar with mining machinery, can readily imagine what would happen to such machine parts if they were not made from the correct material and properly heat-treated.

But all of us are familiar with the reasons why machine parts are heat-treated and it appeared to me that what we were more interested in is "How the heat-treatment is applied."

First of all, we must have the parts or the material from which they are made to heat treat. These may be in the form of forgings or castings, they may have been machined from bar stock, or the bars as received from the mill may be sent you for heat treatment, after which the parts may be finished from the heat-treated bar.

There should be some method of inspection employed whereby all the castings and bar stock received and the forgings made could be thoroughly inspected for physical properties, chemical composition, and defects. The labor wasted in finishing parts made from either the wrong or defective material, which would have been cast aside if it were inspected, usually more than pays for the cost of the inspection.

Then, too, there should be some method of marking the steel for discrimination between the various grades. For nearly all purposes stamping the bar with a steel number works out most effectively. This number can be transferred through the various stages of the machining on to the finished part, so that at any time without consulting job records one can readily see what material the part was made from. This also avoids controversies arising in the event of parts being returned after having seen service.

The selection of a material for a machine part should be governed by the size and shape of the pieces, the requirements to be met in service, whether the heat treatment necessary to produce the physical properties in the ultimate part with the steel selected could be practically applied on account of the shape and size of the part and whether the ultimate cost of the part would be prohibitive.

For certain parts there may be several different kinds of steel that would serve equally as well if given a suitable heat-treatment. For instance, a part fairly uniform and generous of cross-section which must have a hard wearing surface and which would meet with only slight stresses in service could be made from tool steel or any straight carbon or alloy case-hardening steel and in this case the question of the cost of the steel and the heat treatment could decide the selection.

There are other parts, however, which must resist severe shocks or strains in service and at the same time possess great resistance to abrasion for which, possibly, only one grade and analysis of steel would satisfactorily meet the requirements.

Once the steel has been selected from which certain machine parts are to be made it is then up to the manufacturing department to produce those parts on a commercial basis. Very often, particularly in broaching and threading operations, the steel will tear and mush up, due to being too soft, leaving a rough surface and in some cases breaking expensive broaches.

By proper heat-treatment such parts

FIG. 2.

*Asst. Supt. Heat Treating, Ingersoll-Rand Co.

†Asst. Metallurgist, Ingersoll-Rand Co.

FIG. 3.

can be rendered suitable for those operations.

A .10-20 carbon steel quenched in fresh water from 1625 degrees F. and a .12-.22 carbon chrome vanadium quenched in oil from the same temperature in our experience, possess the requisite threading and broaching properties. Through such heat treatment the brinell on .101.20 carbon is raised from 145 to 200 and on the low carbon chrome vanadium from 185 to 205.

A 1.0 per cent. carbon steel which tore badly in broaching and which brinelled 165, when heated to 1420 degrees F. and cooled in atmosphere of shop tested 200 and broached perfectly.

Some heat-treatment should be applied to all forgings, whether they are machined or not, such as an annealing above the critical or a quench from above the critical and a draw to somewhere under the critical (the exact method of heating and cooling, of course, would depend upon the grade of steel). In the case of forgings which, after machinery need no hardening treatment, a treatment necessary to bring out the requisite physical properties in the ultimate part could be applied to the rough forging unless it were of considerable size when it has been found good practice to thoroughly anneal in the rough and apply the finish or "full" heat treatment after the excess material has been machined off. In the case of those forgings which after machining require hardening, the heat treating of them refines them (or normalizes them as some like to call it) to the extent that the machining operations can be speeded up and the parts when they are hardened and less susceptible to distortion.

The distortion in hardening of parts machined from bar stock can be considerably lessened by heat-treatment after they have been partly machined.

Heat-treatment takes in numerous methods of hardening, annealing, tempering, toughening, normalizing, in fact, anything in the nature of an operation where temperature is relied upon to produce certain physical changes in the structure of steel.

Hardening, we know, consists of heating a piece of steel up to a point in or beyond its critical or transformation range and cooling it either slowly or rapidly as the case may require in oil, brine, or fresh water or as in the case of high speed steel, possibly in air. (The word "Hardening" when used throughout this paper is used in terms of shop language and means the rendering of steel in a condition, or with a hardness that resists the action of a file).

The manner in which a piece is heated, the temperature it is heated to, and the way in which it is quenched depend upon the kind of steel the piece is made from, the size and shape of the piece and the properties required in the finished article.

To the average heat-treater there are three distinct kinds of steels: Tool steels, case-hardening steels and the so-called oil-tempering steels.

The tool steels are those which, due to their chemical composition, possess the innate properties for hardening when simply heated to and quenched from in or above the critical range. In this class are those, such as the straight carbons, above .60% and those with the same or a little lower carbon content containing percentage of chromium, vanadium, tungsten or molybdenum.

The case hardening steels are those which, as their name implies, harden only to the depth of a case with which the exterior is carburized. These steels contain, initially, less than .30% carbon and for some purposes appreciable amounts of alloying elements, such as chromium, nickel, vanadium, tungsten and molybdenum.

The oil tempering class takes in the steels of medium carbon content (between .30% and .60%) with or without various proportions of alloys. They are used for purposes where great elasticity combined with ductility are essential.

The Methods of Application

There are many methods of applying heat-treatment. In the modern plant where "heat-treatment" is looked upon in the light of its present importance the methods of handling for heating, quenching, etc., are usually worked out to meet the particular plant conditions.

As the success of a heat-treating plant depends largely on the uniformity of its product and the obtaining of a uniformly heat-treated product is controlled largely by the tools with which the plant is equipped and the ability of those designated to use those tools, serious consideration should be given to the selection of equipment and the type

FIG. 4

of human element employed to operate it.

While the tools of a heat-treatment plant, such as furnaces, the quenching baths, the machinery necessary for the operation of each, the pyrometers, pots, boxes, etc., are of inestimable value, too much emphasis cannot be laid upon the factor of the human element in heat-treating operation, or the importance of the type and intelligence of the man on the job.

Even with the very latest improved systems of pyrometry and temperature control, automatic and continuous furnaces and quenching baths, the man on the job really decides the issue. He determines how the charge is to be placed in the furnace, regulates the flow of gases that make either for the neutral (or perfect) reducing or oxidizing atmosphere in the furnace, whether the work is heated at the temperature as indicated or recorded by the pyrometer, it rests with him to quench the work in the proper manner and then to see that the proper time and temperature are administered in tempering; in fact every heat-treated article has the ear-marks of the human element from every operation upon it. Further, while the articles may be tried for hardness with a file or tested with the Scleroscope, or possibly the Brinell, if the indentation is not objectionable, the damage done by improper heat-treating or the lack of proper heat treatment is not detected until after the piece has been placed in service. Failures in service are annoying to the customer as well as to the manufacturer and we are all looking forward to the apparatus to be designed which commercially will detect faulty heat-treatment as well as defects in the steel without destroying the part. The microscope will reveal these things to the experienced eye, but, as we all know, it invariably means cutting the part in many pieces, and at the best is a long-winded and tedious job.

The lack of means with which to test all parts for the purpose of detecting defects naturally compels those concerned to equip the heat-treating department with those tools which eliminate the personal equation as much as possible and then furnish those supervising the work with a type of human element intelligent enough to operate those tools.

In the hardening of tools the principle applied is the same, no matter where or under what conditions. They must be heated and they must be quenched. In many cases the way in which the work is to be heated is somewhat an optional one. At one place the heat-treater may prefer the use of a semi-muffle furnace of a lead bath, while another may prefer a salt bath or a electric furnace. Excepting a certain method for hardening very particular parts, which we will discuss later on, in my opinion the lead or slightly case-hardening solution bath is to be preferred for heating for quenching. By its use the human element is practically eliminated from the time the work is placed in until it is taken from the bath for quenching, providing some reliable means of determining the temperature is employed. With the use of the open fired or semi-muffle furnace the work is at the mercy of the "man on the job," from the time it is placed in until it is taken out, even though the most accurate temperature indicating devices are employed.

We will suppose that the time temperature curve as shown on a recorder connected to an open fired furnace during a heat was perfect. It is no indication that all conditions in the furnace were perfect. The operator could at any time during the heat use more air blast than is necessary to perfect combustion, producing what we know as an oxidizing atmosphere in the furnace and by so doing oxidize the surface of the work being heated to the extent that the pieces were finished they would be practically worthless when taken from the quench.

On the other hand, taking an extreme case, more oil than is necessary to perfect combustion could be used, producing what is termed a reducing atmosphere to the extent that carbon would be deposited in spots upon the surface of work, rendering those spots hard and brittle when quenched and if the work were of a character having very sharp teeth, corners or projections it could lead to the breaking or flaking off of those sections when quenched. This condition, however, is not as frequently met with as the former, for when the atmosphere is reducing, a black smoke is seen and usually would be corrected by the operator, if he were at all on the job.

The neutral atmosphere, the ideal condition, is obtained when the combustion is perfect. To the experienced heat-treater this is characterized by a clean and soft heat. (By "The Neutral Atmosphere" I mean the one so called by the practical man, but which really is slightly reducing.)

Looking at is from another angle, it is entirely up to the man who observes each individual heat, or should be, to determine the speed with which the work should be heated to the quenching temperature, as he only is in a position to determine whether the work is lagging too far behind the furnace. If the furnace is driven too fast, uneven heating is the result, with the tendency to buckle any long pieces even though the pieces are turned over frequently. Unless governed by thermo-static control (and this is not practical as yet with oil fired furnaces) it is practically impossible for the average heat-treater to operate his furnace so as to produce the same heating curve on every heat.

Then, too, there are other factors over which the operator has no control such as burner trouble, motor breakdowns, pump trouble or the quality of fuel oil used which cause any amount of trouble on open furnace work. For instance: If a heat had been brought up to the required temperature or very near it and to all appearances was perfect in every respect, and the oil became sluggish or a piece of dirt clogged the burner or the fan or possibly the pump stopped, the heat would immediately drop and the tendency on the part of the average man after the trouble was adjusted, on account of having lost time in bringing the work up to the required temperature, would be to bring the heat back to the temperature attained before the trouble arose in the shortest possible time, and would invariably oxidize or distort the work beyond hope of restoration.

These conditions have no effect upon the work heated in a good lead or molten solution as the products of combustion do not come in contact with the work, changes in temperature of work are affected very slowly through the pot and bath, and unless too many pieces are

FIG. 5A.

placed in the bath at one time for heating there is little chance for non-uniform results arising from the heating operation.

Care should be taken, though, to prevent baths from oxidizing the work. In the case of cyanide solution enough pure sodium cyanide should be added from time to time to keep the properties of the bath up to slightly case-hardening and in the case of a lead bath either a coating of wood charcoal or about ½ in. of cyanide solution or potassium chloride and sodium chloride should be kept on surface to prevent oxidation of the lead which would in turn oxidize the work being heated. A coating of cyanide or potassium chloride and sodium chloride solution over surface of lead bath renders work very clean when quenched in water or brine. When quenching in oil it has been found best practice to use the coating of charcoal.

In the hardening of tools such as drills, taps, reamers, broaches, threading dies, etc., from a lead or solution bath or a muffle-furnace it is good practice to obtain a small disc from the bar from which the tools were made, and before proceeding with the hardening of the finished tools, harden the disc in the same manner in which it has been decided to harden the tool. By examining the fracture of the disc a good idea can be obtained as to what the hardening temperatures for the tools should be.

Advice on Production Work

On production work when the machine parts are put through in lots it is always advisable to first harden and break one part and by its appearance regulate the hardening of the balance of the lot.

I know that some of you are thinking right now; what's the use of holding up the job and going to the expense of breaking a machine part in checking up the hardening in such a manner when it should not be necessary if the pyrometers are checked in the right manner and the bath is held constant and the steel is of a definite character, it having been thoroughly inspected, etc. But to this I would answer that even though steel is inspected thoroughly and the quality and temperature of the quenching medium and the accuracy of the pyrometer system is checked systematically, there are variables in the hardening operation which must be allowed for and there is no better way that we know of to ascertain the exact results to be expected in the lot than by first treating and breaking one part. We usually call this piece our dummy.

FIG. 5B.

Very good results have been obtained with tools made from a 1.0% straight carbon steel when heat-treated as follows:

For taps and reamers.

Operation 1. Rough machine from bar stock.

Operation 2. Heat thoroughly, preferably in a semi-muffle furnace to 1425 deg. F. and leave cool in furnace.

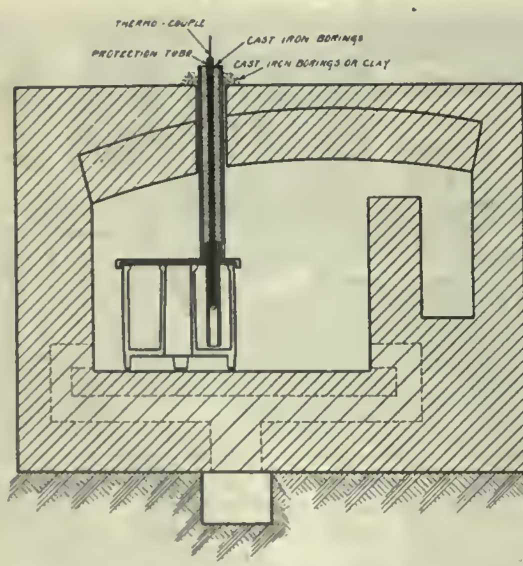
Operation 3. Finish machine.

Operation 4. Preheat in a lead bath to between 1150 and 1200 deg. F.

Operation 5. Transfer to another lead bath heated to around 1400 to 1420 deg. F. and heat thoroughly to 1400 to 1420 deg. F., then quench vertically, tang downward, partly in salt brine at about 70 deg. F., finishing the cooling in oil.

Operation 6. Temper in oil to 425 deg. F.

The second operation, namely, the annealing after rough machining has been found of great benefit in lessening the



METHOD OF PLACING THERMO-COUPLE IN LARGE CARBURIZING POTS
FIG. 6

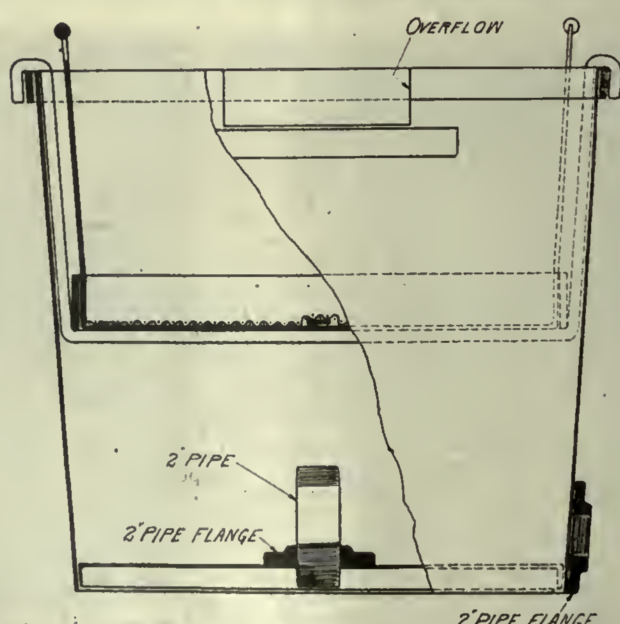


FIG. 7.

distortion in hardening For many tools this way of annealing has proven, in our experience, to be superior to pack-annealing. Operation 4 could be performed in a semi-muffle if care is taken to see that furnace has been treated thoroughly to the specified temperature before the tools are placed in for preheating and that the tools are not laid too near the edge of the tile or over a joint or crack in furnace where parts of tools perchance might be subjected to a flame or intense heat. The latter precaution cannot be over-emphasized, for it has been found that a large proportion of the "running off" of the corners of tools in hardening were the results of "fire cracks."

Good results have been obtained with broaches up to 48 in. long made from 10% straight carbon steel by first machining them from bar stock and hardening as follows:

Preheat in a semi-muffle furnace at 1200 deg. F. turning broaches over in furnace frequently to insure uniform heating. When thoroughly heated transfer to a lead bath covered with cyanide of salt solution and heat to 1400 to 1420 deg. F. and quench, vertically, almost entirely in salt brine finishing the cooling in oil. These are not tempered. By wrapping the undercut sections between the teeth of broaches with asbestos cord the effect of quenching is retarded to the extent that they are left somewhat soft in those sections, thereby facilitating the straightening of them without much fear of breaking in the event of their distorting in the hardening operation.

Gauges made from tool steel are hardened by several methods. Those with plain surfaces, where it is possible to grind after hardening are usually finish machined, less grinding, from the bar, then hardened by heating slowly to 1400 to 1440 deg. F. (the temperature depending upon the size of gauge), quenching entirely in salt brine and drawing in oil to 400 deg. F.

The hardening of thread gauges is a somewhat different problem. Because of the inability to grind them they are finished to size before hardening and must be held to shape in hardening Many of these gauges are finished to as close as .0025 in. and must hold those sizes through the hardening. If they shrink in hardening they are doomed for the scrap pile. If they expand there is a chance of using them by lapping; but as lapping at best is a long drawn out, tiresome and expensive operation, the hardener is given no room for excuses.

A practice followed for a long time with good results consists in:

First. Rough machining from bar stock.

Second. Heating thoroughly in semi-muffle furnace to 1425 deg. F., leaving cool in furnace.

Third. Finish machine.

Fourth. Packing all over in carburizing compound and heating at 1425 deg. F. for 3 to 4 hours after heated through, leaving cool in pot.

Fifth. Unpacking then repacking (with the gauge in a position opposite to the position it was packed in for the previous operation), heating at 1425 degrees F., for 3 or 4 hours after heated through and cooling directly from pot entirely in a good mineral oil.

Reference will be made later on to another method of hardening whereby the distortion of parts is minimized.

The case-hardening of steel is, as mentioned previously, a process of hardening whereby articles of low carbon steel are given a hardness in the form of a case on the surface. This process should not be confused with the hardness often obtained on articles of tool steel which very closely resemble case-hardened alloy steel.

A case hardening steel, being of low carbon content is devoid of the qualities possessed by a tool steel, of hardening when simply heated and quenched, and must necessarily have those properties added to it. These properties are added in the form of carbon to the exterior and the particular operation is called "carburizing."

There are three distinct methods of carburizing, namely, the "dry" or "pack-carburizing," "gas-carburizing," and the "liquid-bath" methods, each of which has its own particular advantages.

The first step to take in case-hardening is to determine the depth of case with which the article must be carburized and hardened to function properly in service. This should be decided jointly by the engineers who were responsible for the designing of the piece and those responsible for the selection of the steel from which the part was made. This done, the method whereby the best results are obtained, together with the least cost, should decide which of the three methods of carburizing is to be employed.

The "dry" or "pack-carburizing" method consists of packing the articles to be carburized in pots or boxes with a solid carbonaceous compound and heating to a temperature above the upper critical long enough to obtain the depth of case desired, after which the articles are either left cool in the boxes or quenched directly from the boxes in oil or water. The carburizer, the pots or boxes and the furnaces used in the application of this method are of equal importance and serious consideration should be given to each. Of all heat treating operations, the carburizing surely is the one where "uniformity" should be the slogan, and, while the other factors making for the complete operation are important, the carburizing compound and its selection is of paramount importance.

The selection of a carburizer should be made after first conducting a thorough test on various brands. Tests on carburizers if conducted in the proper manner are somewhat elaborate, they need the very closest supervision, and are expensive to say the least, and once having made a selection, with which the satisfactory results were obtained, the heat treater should not be bothered about conducting tests annually to prove that the fellow who offers a carburizer for less monely, with the story that it is more efficient than all others, is a frost, but should be concerned only about obtaining the same material from time to time that was selected. What is needed most is a uniform carburizer. There are good commercial compounds on the market to-day from which the heat treater should have no trouble making a selection. In my opinion it is to be expected that the carburizer purchased from a reliable manufacturer handling thousands of tons yearly would be of a more uniform character than one's own make. The manufacturer is fully equipped for the preparation of it and handles the raw material in a much larger bulk than the average individual could afford to. Some men making up their own compound say, yes, but look what I'm saving. That's a question everyone must answer for himself.

The most expensive compound is not always the best and I know that we are all after economy of operation, but a cheap carburizer is often false economy.

(To be Continued in Our Next Issue.)

AN OPPORTUNITY WORTH WHILE

In this week's issue of CANADIAN MACHINERY is an article on "Some of the Methods of Heat Treatment." This article is one of many that we hope to present on this important subject, for as time goes on the value of proper heat treatment is becoming more and more recognized.

We suggest that readers desiring to follow up all important developments in the heat treatment field get acquainted with Toronto Chapter of the American Steel Treaters' Society.

This body of men meets once a month and prominent speakers will present papers and lectures from time to time. Experience meetings will also be held; in fact it will be a real get-together club. You need not reside in Toronto to become a member, for if you so desire reports of all meetings will be forwarded you should you be unable to attend personally.

Investigate this for it will more than repay you, the price of membership being far from prohibitive. Write Mr. Lowry, chemist of the Massey-Harris Co., Toronto, if interested.

According to statistics published by the Association pour les Interets Miniers d'Alsace et de Lorraine, and quoted by the Iron and Coal Trades Review, the output of iron ore in Alsace Lorraine was as follows in metric tons:—10,000,000 in 1918; 13,000,000 in 1917; 13,000,000 in 1916; 10,000,000 in 1915; 14,000,000 in 1914; and 21,000,000 in 1913. The coal output during the same period was 2,600,000 tons in 1918 and 1917, 2,020,000 in 1916, 1,900,000 in 1915, 2,800,000 in 1914, and 3,700,000 in 1913.

Handy Chart for Design and Pin Connections

By JOHN S. WATTS

THE accompanying chart gives the dimensions of double eye pin connections for transmitting motion by connecting rods through levers, bell cranks, etc., for all loads in tension or compression up to 30,000 pounds.

Knowing the load, to use the chart, follow along the horizontal line for that load and read off the dimensions for each part at the nearest higher size in each column.

For example, to determine the dimensions for a double eye connecting rod, to transmit a load, both in tension and compression of fifteen thousand pounds.

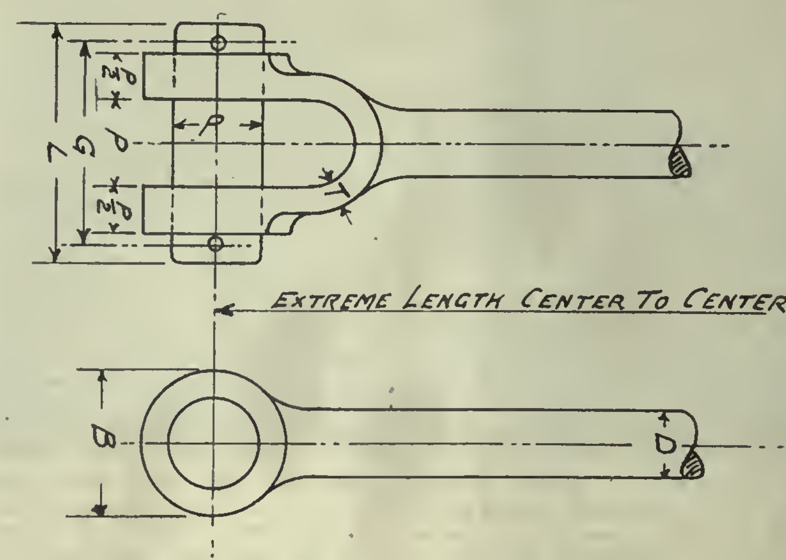
Following along the fifteen thousand pound horizontal line we find that the diameter of the body should be 1¾ in. if the length centre to centre of pin holes does not exceed 52½ in. The diameter of the pin and the width between the jaws should be 2¼ in., and the outside diameter of the eye 3⅝ in. Pin will be 5 in. long between centres of cotter pin holes, and 6 in. long overall. The cotter pins will be 5-16 in. diameter by 3¼ in. long, and the metal in the sides or jaws of the double eye will be 11-16 in. thick.

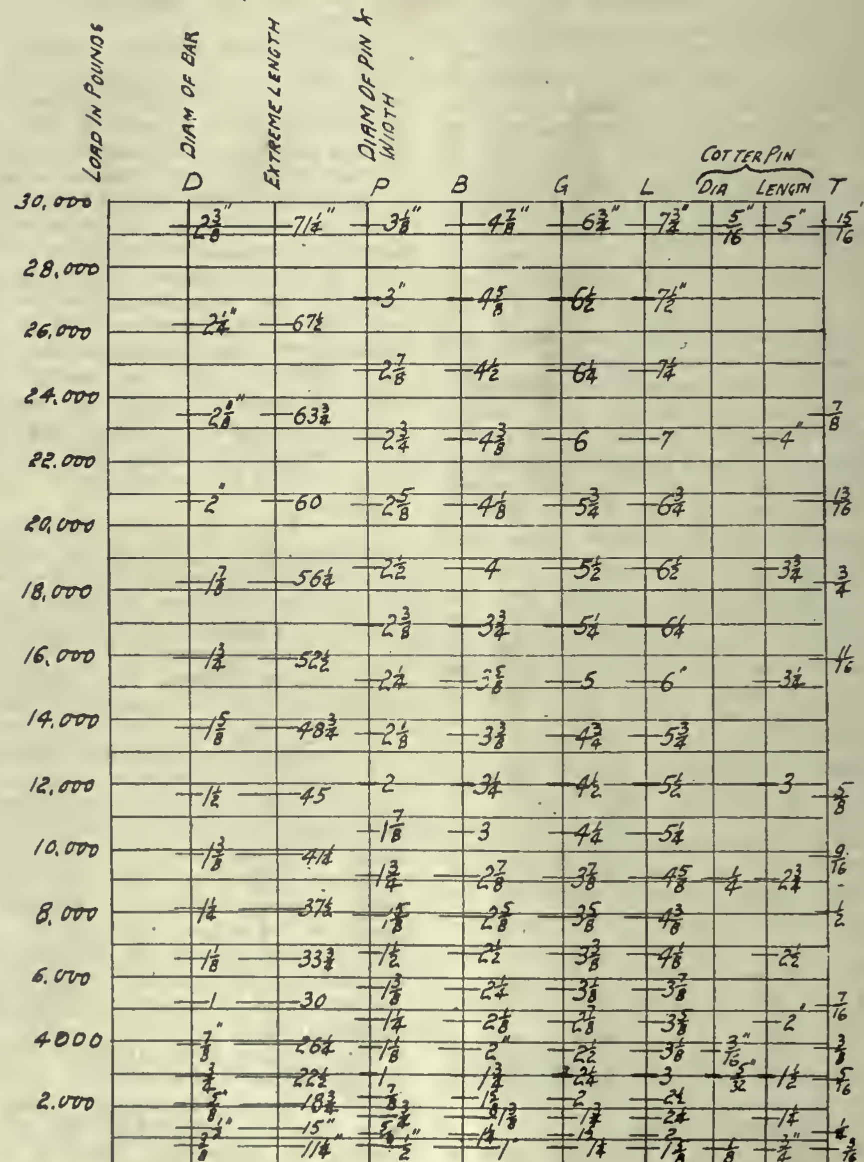
The limit in length, as given under the column marked extreme length, is to take care of the fact that the connecting rod acts as a column when under compression, and if the length must be greater than that given the diameter must be increased to keep the ratio of length divided by radius of gyration not over 120. In very long rods this can be done very nicely by making the rod from a piece of pipe, welded to the double eyes at each end. This increase in the diameter D does not affect the other dimensions. If the connecting rod is only subject to tension the extreme length limit may be ignored.

When designing connecting rods for use with hand or foot levers, it is better to disregard the calculated pull required to operate the mechanism, and, indeed, use the maximum pull that can be exerted on the hand or foot lever by the operator, as it is more than probable that this maximum pull will be exerted on the lever some time or other, either by ignorance or because of some stiffness in the mechanism. This maximum pull may be safely assumed at 120 pounds on a hand lever, and 200 pounds on a foot lever.

The basis upon which the chart is constructed is as follows: The diameter of the bar is that diameter at which the load will give a stress of 6,600 pounds per square inch, and this is the stress that is used throughout on account of the load being intermittent and reversing.

The extreme length is that at which the ratio $\frac{\text{length}}{\text{radius of gyration}}$ equals 120,





THE TABLE AND DIAGRAM WILL NO DOUBT BE EASILY UNDERSTOOD.

which, as the radius of gyration of a circular bar, is the diameter divided by 4, is equal to thirty times the diameter of the bar.

The diameter of the pin and the width of the bearing between the jaws, is such that the load will impose a pressure on the bearing surface (diameter of pin multiplied by width of bearing) of 3,000 pounds per square inch. It may be admitted that this gives a larger bearing surface than is generally used, but a long experience in repair work has proved to me that this bearing pressure should not be exceeded. The higher bearing pressures sometimes used to cause the pins and pinholes to wear out very rapidly and shorten the life of the machine considerably.

Making the width of the bearing surface equal to the diameter of the pin gives us better proportions than a smaller pin with a wider bearing or a larger pin with narrower bearing.

The diameter of the eye B is calculated to give a net area of metal to resist tearing across the eye, such that the stress, due to the load, will not exceed 6,600 pounds per square inch after the hole has been worn and reamed out for a new pin one-quarter of an inch larger in diameter than the original pin.

The thickness of metal in the jaws is that which will give an area of section $D \times 2 \times T$ equal to the area of the body, i.e., $\frac{\pi}{4} \times D^2$.

It will be seen that the sizes given in the chart can be used with all confidence as being of ample strength to withstand continually reversing stresses and rough treatment.

RULES FOR WELDING OF INSURED BOILERS

By "autogenous welding" is meant any form of welding by fusion, that is, where the metal of the parts to be joined or added metal used for the purpose is melted and flowed together to form the weld. Such welding is accomplished by the oxy-acetylene, hydrogen or other flame processes, or by the electric arc; no distinction is made between any of these processes. The general rule to govern the acceptance of such welds in insured vessels is that prescribed by the Boiler Code of the American Society of Mechanical Engineers, Par. 186, as follows:

> "Autogenous welding may be used in boilers in cases where the strain is carried by other construction which conforms to the requirements of the code, and where the safety of the structure is not dependent upon the strength of the welds."

The following illustrations will serve to point out where such work should be accepted or rejected:

1. Any autogenous weld of reasonable length will be permitted in a staybolted surface, or one adequately stayed by other means so that should the weld fail, the parts would be held together by the stays. It is necessary for the inspector to use judgment in interpreting the meaning of "reasonable length" as given above, since it may vary in different cases. In the average case it should be not more than 3 ft. Autogenous welding will not be accepted in unsupported surface.

2. The edges of the inner and outer sheets of vertical firebox boilers or boilers of the locomotive type may be joined by autogenous welding to form the door openings, if the surrounding surfaces are thoroughly stayed. This would also apply to other openings of a similar character in such surfaces.

3. For low pressure plate steel boilers operated at a pressure not exceeding 15 lbs. to the square inch, or for higher pressures in unfired vessels subjected to water pressure only, rectangular headers may be autogenously welded at the edges if the sheets are properly held together by stays. Autogenous welding of cracks and fractures in cast iron boilers will not be permitted.

4. Fire cracks in girth seams extending from the edge of the plate to the rivet hole may be autogenously welded, provided the cracks are properly prepared by cutting out the metal at the crack in the form of a letter "V" to permit fusion through the entire thickness of the plates.

Similar cracks in girth seams located between the rivet holes may also be autogenously welded, provided the cracks do not extend beyond the edge of the lap of the inner plate. In the latter class of cracks it is advisable to drill a hole not exceeding 3-8 in. in diameter at the end of the crack before the weld is made. Cracks extending from rivet hole to rivet hole on girth seams cannot be welded. Calking edges of girth seams may be built up by autogenous welding under the following conditions: The original section of the metal between rivet holes and calking edge to be built up must average equivalent to ¼ of the diameter of the rivet hole and the portion of calking edge to be replaced must not exceed 30 in. in length in a girthwise direction. In all repairs to girth seams by autogenous welding the rivets must be removed over the portions to be welded and for a distance of at least 6 in. at each and beyond such portions. After repairs are made the rivet holes should be reamed before the rivets are redriven.

5. Stayed sheets which have corroded to a depth of not more than 40 per cent. of their original thickness, may be reinforced or built up by autogenous welding. In such cases the stays shall come completely through the reinforcing metal so as to be plainly visible to the inspector.

6. Where tubes enter flat surfaces and the tube sheets have been corroded the ends of such tubes may be autogenously welded to the tube sheets. The above-mentioned repairs for tube sheets and the welding in of tubes in the sheets are not to be permitted where such sheets form the shell of a drum or boiler, such as in the case of Stirling type of boiler.

7. When external corrosion has reduced the thickness of plate around handholes to not more than 50 per cent. of the original thickness and for a distance not exceeding 2 inches from the edge of the hole, the plate may be built or where cracks exist between the tube ligaments, autogenous welding may be used to reinforce or repair such defects.

8. Pipe lines will be accepted where the flanges or other connections have been welded autogenously, provided the work has been performed by a reputable manufacturer and the parts properly annealed before being placed in position. Such welding when made with the part in place and unannealed will not be acceptable.

9. Autogenous welding in patches in the shell of a boiler will not be acceptable regardless of the size of such patches. Autogenous welding of cracks in the shell of a boiler—except those specified in Par. 4—regardless of the direction in which they may lie, will not be permitted, unless such welding is only for the purpose of securing tightness and the stresses on the parts is fully cared for by properly riveted-on patches or straps placed over the weld. The plates at the ends of joints may be welded together for tightness, provided the straps or other construction is ample to care for the stresses on the parts so welded.

10. Re-ending or piecing of tubes for either fire tube or water tube boilers by the autogenous process will not be permitted.

The production of pig iron in the United Kingdom in February amounted to 645,000 tons, or 20,000 tons less than in January. When allowance is made for the shorter month, however, the rate in February was rather higher than in January, the daily rate being 22,300 tons, against 21,500 tons. The production of steel ingots and castings amounted to 798,000 tons, or 44,000 tons more than in January, and was higher by 40,000 tons than the best month in 1919—viz., March, when the production was 758,000 tons. The 645,000 tons of pig iron included 234,000 tons of hematite, 223,000 tons of basic, 170,000 tons of forge, foundry, and other qualities, and 18,000 tons of alloys.

Discussion of Strains in Rolling of Metal

This Abstract Touches on a Most Vital Subject to Those Interested in Rolling of Metals—The Original Paper Was Presented Before the American Society of Mechanical Engineers at Their Annual Meeting

By ALFRED MUSSO, General Manager of the Coast Coaling & Eng. Co.

WHEN a piece of metal is put through the rolls in a rolling mill, its linear dimensions are strained and the whole piece itself is deformed; in other words, the thickness of the piece becomes smaller while its length and width are increased. These strains are the effect of the pressure which the rolls exert on the piece, and as introductory to our specific subject we will first consider the behavior of a piece of metal under compression.

Let ABCD (Fig. 1) be the cross-section of a piece of metal as subjected to the pressures P and P_1 normal to the faces shown in cross-section as AB and CD. When the compression is carried beyond the elastic limit of the material, the two faces AB and CD will come closer together as shown by the dotted lines A_1B_1 and C_1D_1, while the two sides faces AC and BD will bulge outward as shown by the dotted curved lines A_1C and B_1D_1, and if the forces P and P_1 are still increased the piece will ultimately fail by shearing along its diagonals.

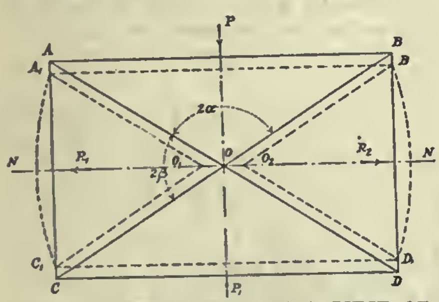


FIG. 1—CROSS SECTION OF A PIECE OF METAL SUBJECTED TO PRESSURES P. & P.

The ultimate behavior of the failing piece is influenced by the structure of the metal itself. In fact, experience shows that ductile metals possessing a homogeneous structure, such as copper, aluminum, etc., will become plastic and flatten down to a disk, while fibrous metals, such as steel, wrought iron, etc., where strength across the grain is much lower than with the grain, are not susceptible of any plastic state at all and will ultimately fail by splitting sideways. As it is beyond our present scope, however, to discuss this subject of the failure of metals under compression, it is sufficient for our purpose to regard the piece as shown by Fig. 1 as divided into six pyramids having as a common vertex its pressure centre O, and as bases its six faces.

It is obvious that while the compressive forces P and P_1 are tending to telescope into each other along the pressure line PP_1 of the upper and lower pyramids, the other four pyramids will be pushed outside by the expulsive forces R_1 and R_2 consequently set up by the aforesaid pressures P and P_1. The value of the expulsive forces evidently depends on the two angles AOB and AOC, ordinarily known as pressure angle and expulsion angle, respectively. We will now apply the foregoing considerations to the rolling-mill process, and begin our investigation of the effects of the roll pressure at any point of the surface of the piece being rolled.

Let Fig. 2 represent a cross section of a rolling-mill through the rolls. NN_1 is the piece of metal going through the rolls C and C_1. Inasmuch as the pressure is exerted radially we may consider it at any point, say at A, which is the initial point of the contact arc AMB. The pressure P may be resolved into two components, one normal to the piece and the other parallel to its surface, as follows:

$n = P \cos b$, normal component

$m = P \sin b$, parallel component

where b = angle ACB, known as the approach angle. The directions of the components clearly show that while n is the force which actually compresses the piece, m is the component of the pressure which hinders the piece from entering the rolls, and unless n is larger than m, the rolls will not grip the piece.

The useful limit of b is easily found from the relation $n > m$, from which $b < 45$ deg. The actual value of b for metals is given by $\tan b = c$, the coefficient of friction between roll and piece, but for metals $c = 0.577$ (approx.), therefore $b = \tan^{-1} 0.577 = 30$ deg., which, according to actual practice, is the maximum value of the approach angle for which the rolls will grip the piece.

Let us now deal with the effect of the pressure on the whole arc of contact A B. We may consider the pressure as applied to the middle point M and the whole piece represented in cross-section by ABB_1A_1 will be divided into pressure pyramids with a common vertex at O. In accordance with previous remarks concerning the behavior of a piece under compression, we deduce that part of the piece bounded by the contact arcs and shown shaded in the figure is pushed outward by the rolls in the direction of the pass, consequently it is the one we must consider in looking for the elongation of the piece. Obviously, when the piece has gone through the rolls, the shade area OMB_1M_1 will have been transformed into a rectangle, its height being equal to the pass and its base longer than the average base of the original expelled part.

Determination of Elongation. In the complete paper an expression is derived for the shaded area $OMBB_1M_1$, which, as previously noted, must be equal to the area of a rectangle of height b and base of length l, where p = pass (BB_1). The value of l is given by the equation:

$$l = \frac{1}{p}\left(\frac{(2r+p)^2(t-p)}{8r \sin b} - \frac{3.14r^2}{360} b\right) \quad [1]$$

and the value of the average base l_0 of the shaded area by

$$l_0 = \frac{1}{2}\left(\frac{(2r+p)\ (t-p)}{4\ r \sin b} + r \sin \frac{b}{2}\right) \quad [2]$$

in which r is the radius of the roll and t the original thickness of the piece (AA_1).

The elongation e of the piece will evidently be $l - l_0$, and referring e thus found to the total length of the piece gripped by the rolls, we will have the elongation per unit e_1. Also the total length of the piece gripped by the rolls is (Fig. 2) AF = r sin b, whence the percentage elongation e_2 will be

$$e_2 = \frac{100\ e}{r \sin b} \quad \ldots\ldots\ldots [3]$$

Equation [3], besides showing the elongation obtained by rolling a piece of metal, furnishes also other valuable information, namely, a check on the safety of the rolling operation, by comparing the e with the tensile-strength test of the material in question. In the event that the value of e is too large for safely straining the piece, or should it happen to be too conservative, it will always be possible to readjust the pass of the roll-

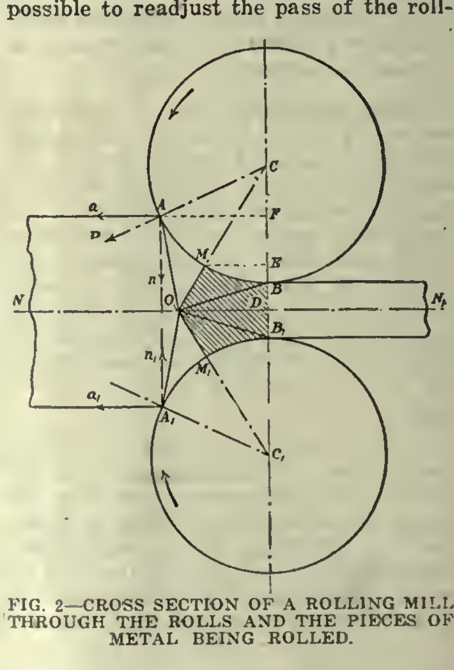


FIG. 2—CROSS SECTION OF A ROLLING MILL THROUGH THE ROLLS AND THE PIECES OF METAL BEING ROLLED.

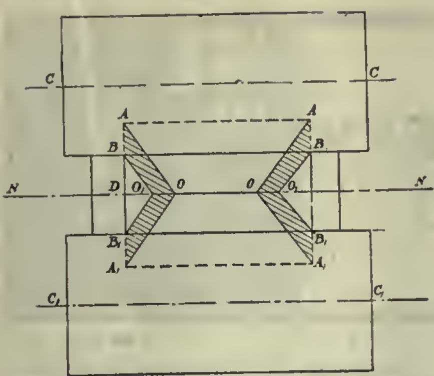


FIG. 3—LONGITUDINAL CROSS SECTION OF A ROLLING MILL THROUGH THE ROLLS.

ing mill to suit, because e is a function of b.

In order to find the side spread (s) of the piece caused by the roll pressure, will refer to Fig. 3, which is a longitudinal cross-section through the rolls. Let CC and C_1C_1 be the axes of the rolls, AA_1=t the original thickness of the piece and BB_1=p the pass. In this case, since the expulsion angles AOA_1 are equal for both sides of the piece, the total spread will be twice the spread of one side.

By reasoning the same as in the case of Fig. 1, we can easily see the amount of side spread is given by the shaded areas, namely, AOA_1 and B_1O_1B. In this case the shaded area is given by the difference of the areas of the triangles AOA_1 and BO_1B_1, which depend upon the value of the pressure angle a because angle DAO=a/2. In the complete paper it is shown that

$$\frac{a}{2} = \tan^{-1}\left(\frac{\left(r + \frac{p}{2}\right)\tan\frac{b}{2}}{\frac{p}{2}}\right) - \frac{b}{2} \quad \ldots\ldots [4]$$

It should be noted that the pressure angle is also a function of the approach angle b, and once the value of the pressure angle has been calculated it is easy to find (Fig. 3) the area of the shaded portion, which divided by the pass will give the amount of the side spread at each side of the piece, namely,

$$s = \frac{(t^2 - t^2)}{p} \tan\frac{a}{2} \ldots\ldots\ldots [5]$$

If w is the width of the piece, the total spread per unit of width will be $2s_1$= 2s/w, and the percentage spread

$$2s_2 = \frac{200\,s}{w} \ldots\ldots\ldots\ldots [6]$$

Equation [6] shows that the side spread is independent of the width of the piece, but it depends entirely on the values of the original thickness t and the pass p.

In conclusion the author wishes to present a practical application of the foregoing formulae by solving the following problem: In the cold-rolling operation a strip 0.20 per cent. carbon steel is put through a 10-in. mill. The strip before rolling is 2 in. wide and 0.065 in. thick. The pass is 0.050 in. Find the percentage elongation and side spread.

The first step is to find the approach angle. The fundamental equation of a rolling mill is

$$t = p + 2r\,(1 - \cos b)$$

Substituting and solving, it is found that b=3 deg. 8 min. Also from the above data and Equation [4], a/2=78 deg. 7 min.

We can now dispose our data as follows:

Roll radius, r=5 in.
Original thickness, t=0.065 in.
Pass, p =0.050 in.
Width of strip, w=2 in.
Approach, b=3 deg. 8 min.= 3.133 deg.

$\sin b = 0.05466$

$\cos b = 0.9985$

$\sin\frac{b}{2} = 0.02734$

$\tan\frac{a}{2} = 4.75219$

The elongation, using Equations [1], [2] and [3] is found to be 0.06275 in., or in percentage, $e_2 = \frac{6.275}{5 \times 0.05466} = 24.6$ per cent. of the original length of the piece gripped by the rolls.

Interesting Facts to be Found in This Week's Advertising Section

- How to prevent idle time of men and machines.
- How to save oil.
- What to do if a nut gets loose.
- Why a bench lathe is sometimes best.
- How to procure a healthful drink.
- A blast gate that has given entire satisfaction.
- The method of milling chilled rolls.
- How to record time spent in operations.
- A shear that can cut 7"x1¼" flat bars, round bars of 2½", and other large work.
- Where to secure steel for every commercial purpose.
- A tool holder that won a grand prize.
- How to secure steel castings of all sizes from 5 to 5,000 pounds.
- How to reduce cutting-off costs.
- How to save time in changing drills.
- How to take deep cuts without pause or chatter.
- How to eliminate spoiled work.
- A fine piece of history about Major Anderson, the defender of Fort Sumter.
- A chuck which has reversible screws.

The side spread on either side, from Equation [5] is s = 0.164 in., and the percentage spread from Equation [6] is 16.4 per cent.

The result thus obtained evidently shows that the percentage spread is inversely proportional to w, the width of the piece. Now, because of the fact that in rolling-mill practice we are interested only in obtaining the highest possible value of the elongation e, the best economic operative conditions will be furthered by using a strip as wide as possible consistent with the dimensions of the rolls, the power of the mill and above all the degree of uniformity desired in the thickness of the finished strip.

The output of tungsten ores in the Malay States has increased during recent years owing to the high prices they fetch. In 1914 the output was 261 tons; 1915, 292 tons; 1916, 518 tons; 1917, 761 tons; and 1918, 370 tons. Tungsten ores are usually found mixed with tin ores.

According to a statement in a New York newspaper, the vice-president of the Pennsylvania Railroad said that, as compared with two years ago, the company had 14 per cent. more men to do 11 per cent. less work; or, put another way, it took 127 men in 1919 to do the work of 100 men in 1917. In 1917 the day was one of ten hours; now it was eight hours. In 1917 the average number of traffic units per man was 113,932. With the shorter day this would have worked out at 91,145; actually it was 89,308. In the shops there was an eight-hour instead of a ten-hour day, but piecework had been abolished, and the output per man had fallen from 100 per cent. to 75 per cent. With the eight-hour day the output per day was but 60 per cent. In other words, it takes ten men to-day to do the work of six men two years ago.

According to "Engineer" a series of motor tractors burning palm oil or other vegetable oils grown in Africa is to be organized in Belgium by the Colonial-office, Department of Agriculture. Foreign tractors will be eligible for the trials. Two awards of 15,000f. and 10,000f. respectively will be made to the two best tractors burning fuel oil or some similar grade of heavy petroleum residue. The tractors must be able to give a total pull of 1,000 kilos. on the draw-bar at a speed of 2 miles per hour. Preference will be given to tractors weighing not more than 3,500 kilos., suitable for the rough roads of Central Africa. The trials will be held near Brussels, probably next April, and will last six to ten days. The tractors will be tried on ploughing, belt driving, and hauling of transport wagons—up to about 30 miles a day. Particulars of these trials can be obtained at the Agricultural Department of the Ministry of Colonies, 7, Rue Theresienne, Brussels, Belgium.

WHAT OUR READERS THINK AND DO

TEST GAUGE FOR LOCKING LEVER

By Robert Mawson

ON SOME parts where various machining operations are performed it is essential that certain finished surfaces are produced in the correct relative positions.

If these surfaces vary their proper function is uncertain, and the effectiveness of the finished machine is impaired.

In Figure 1 is shown the detail of a locking pin lever, the first machining operation on which is drilling and reaming the 3-8 inch hole at a distance of 4 1-16 from the left hand end.

The lever is then held in vise jaws located by a 3-8 inch pin, and the end marked 1st cut Fig. 2—machined using two formed cutters as illustrated.

The lever is then reversed, placed in a locating pin and also located on the vise jaws, which are machined with a similar contour to that produced on the lever.

The second cut—marked 2nd cut—is then made on the piece, using a formed cutter as shown.

The lever is again reversed, located on a pin and with the vise jaws also locating the piece by means of surfaces which have been machined with similar contours to that produced on the lever at the second cut. The third milling operation—marked 3rd cut—is then made using the same formed cutter as that employed on the second cut.

It is obvious that providing the various formed cutters have been made with the correct outline and the several vise jaws correctly made by the tool maker, and further that these various tools have been properly used by the machinist all the levers should be exactly alike in outline and the machined surfaces in their correct relative positions.

This, however, is taking too much for granted, too many factors, human and mechanical, enter into the question.

A testing fixture was therefore designed and made as shown in Fig. 3, so that a check can be made on the finished machined parts.

The body of the testing fixture is made of cast iron, which is machined all over. A pin, made of tool steel, hardened, is driven into the body, the projecting portion being a good sliding fit for the 3-8 inch reamed hole in the lever.

At the right hand end is fastened a tool steel block set at the correct angle and distance from the locating pin.

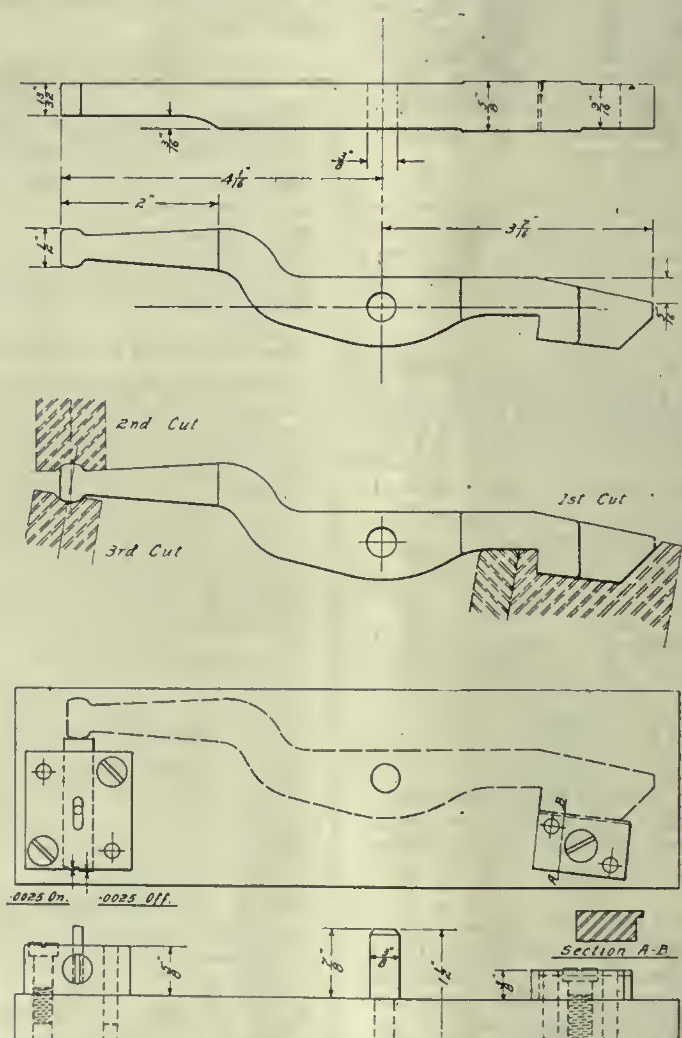
By referring to the section A-B it will be noticed that the block is cut away except for a width of 1-16 inch at the upper edge. This is done so that a feeler may be used to determine whether the lever surface being tested fits properl against the surface of the block. At the left hand end another block is fastened, in the centre of which is a limit gauge which may be slided against the lower end surface of the lever.

To test the lever it is placed on the locating pin and pushed against the right hand block, the contact being tested by means of a feeler gauge as previously stated. The sliding pin in the left hand block is then pushed against the leve: as shown.

The gauge pin is made with limits of .0025 inch plus and minus and the inspector can easily determine by touch whether the machined lever meets these requirements.

If it be found that the gauge pin either projects or can be pushed in beyond the limits it will prove that the cutter set up for either the second or third cuts were wrong, in one case too low and in the other too high in relation to the vise jaws.

The positions must therefore be changed so that the lever will meet the demands of the testing fixture and yet remain the 1-2 inch width called for on the lever detail.



READING FROM TOP WE SEE FIGS. 1, 2, AND 3 IN CONSECUTIVE ORDER.

OXY-ACETYLENE AND THE SCRAP HEAP

By F. A. McLean

IT is not so many years ago that plant owners, managers, superintendents, and other officials were prone to regard their scrap heaps as necessary evils, unredeemable, and all attempts at reclamation as more or less worthless, or a foolish waste of time.

How different is the state of affairs that exists in this regard to-day and the two things which have perhaps been more instrumental in bringing this condition about than all others put together, are the late war and the modern oxy-acetylene welding outfit.

In the old days, all too many scrap heaps used to be the broad highway for escaped profits and huge financial losses. Go anywhere in the neighborhood of large mines, steel mills, shops, foundries, or other industrial plants and what motley collections of blasted hopes were to be found.

During the war, with the prices of raw materials soaring to dizzy heights, plant managers and factory men began to cast reflective glances at their scrap heaps and usually found large aggregations of broken or partially worn-out machinery, machine tools, pieces of tool or alloy steel, tubes, plates and other odds and ends that naturally represented considerable profit thrown away, but, which from the lack of necessity, of knowledge, or of ways and means, would, in normal times, have graced the landscape or the vista of some out-of-the-way corner of the plant until its huge proportions required the attention or excited the avarice of some wandering junkman, in which case some use was made of the material—it found its way after careful sorting at the hands of some Jacob or Isaac and his tribe into the voracious maw of an open hearth furnace, brass foundry or lowly cupola.

In the case of isolated plants, remote mines, etc., such apparatus as found its way to the scrap pile usually finished its career through the action of the snow and rain, as rotting rust in the ground from whence it came.

Confronted with the problems of labor shortage, raw material shortage and long-time deliveries of machine tools and other equipment, many of the more resourceful plant executives enlisted the services of a modern acetylene welding outfit and put much of their old equipment into service once more with much profit, as in most cases the equipment had long since been written off their books.

A large Western mine recovered from their junk piles broken dollies and dies for their drill sharpening machines, which, through the medium of the ever-ready acetylene torch, were soon rendered fit for further service at about one-tenth of their original cost.

A Pacific Coast mine saved several hundred dollars by welding a large crusher frame, or rather several thousand dollars, if one takes into consideration the length of time that the mill would have been running under a handicap during the weeks or months that would have elapsed before a new frame could be cast, machined and shipped from the East.

Another mine, at trifling cost, put back into service a year's supply of broken-bottomed tram buckets, several months' supply of broken stamp mill stems and odd lengths of tungsten steel, as well as a number of manganese steel crusher plates or checks which were too large for their machines.

A great steel mill reduced a shutdown which might have run into many weeks to a matter of 48 hours or so by welding a giant spur gear and thus saved many thousands of dollars.

One of the shipyards on the Pacific Coast had the misfortune to fracture the frame of one of their hydraulic presses and through the good offices of a local garage man and a portable welding outfit the press was soon back at work again, notwithstanding the fact that this was the first job of the kind the garage man had ever tackled. This yard now has a first-class welding equipment of its own.

Into one of the dockyards on the Atlantic seaboard floundered and limped an ocean-going freighter with a broken rudder post, and here again acetylene welding saved time and money for the owners.

In one of Canada's largest textile mills, running twenty-four hours a day, the breakage of some small parts of their complicated machinery is an almost daily occurrence, usually tying up the machine for a matter of a few minutes or hours at the most, since an acetylene welding outfit is an outstanding feature of their up-to-date repair shop.

Midst all of the smooth-running hurly-burly of a mammoth daily newspaper plant, a press suddenly breaks down through the failure of some minor, but none the less important part, while there are yet several thousand copies to be run, and again acetylene saves the day and incidentally the publishers' reputation for having "Never missed an issue in two or three decades."

During the war many railroads were hard pressed for rolling stock, and many a cracked locomotive frame and driving wheel owe their resurrection to the oxy-acetylene process with thousands of dollars in savings to their owners through the reclamation of discarded equipment.

Cast gears are likely to have a nasty habit of shedding their teeth, often when least expected, and one milling concern whose junk heap was swollen by these toothless wrecks, cast about for ways and means to use them again. On examination it was decided that many of the gears could be repaired and an acetylene welder was called in and proved himself a skilful dentist by fusing new teeth into the castings, which were thus made as good as new and kept many dollars in the company's coffers for the shareholders.

In the ordinary machine shop, lathes, planers, millers and other machine tools which are sometimes broken, are often easily repaired by welding the broken parts. Small pieces of high speed steel are welded to cheaper shanks or bodies to form lathe, planer, or slotter tools, milling cutters, etc., and many pieces of tool steel which were once regarded as waste are now used up to the last fraction of an inch.

What the oxy-acetylene torch has done for the automobile owner and the garage man is too well known to need comment. Now-a-days any piece of metal, be it steel or iron, cast, wrought, or malleable, sheet, tube, or bar, brass, bronze, aluminum, aluminum alloys or the precious metals, such as platinum, gold and silver, may be easily welded and made new again by the intense heat of 6,300 degrees Fahrenheit produced by the burning of acetylene in oxygen which fuses these metals so that they run like wax and which might virtually be said to weld the broken parts by remoulding them.

Some of the first attempts at organized espionage and war on the waste pile seem to have originated in England before the war. In a popular magazine published in 1913 there appeared an article on the career of a young Englishman who was said to have been paid a percentage on the money which he recovered from his employers' scrap heaps which brought him in an income of about $20,000 a year.

It used to be said that the United States had the biggest scrap heap in the world, and perhaps Canada was not far behind, but with the well-organized campaigns against waste now carried on by most of the big railroads, mines and industrial plants, this would be a hard statement to prove at the present time.

The war in itself was a great creator of waste, yet in view of the resourceful and efficient methods adopted to realize as much as possible from worn-out or discarded material, no one can fail to have other than ardent admiration for the skill and foresightedness of the men in charge of this department of the work.

In the midst of the great cry for the conservation of natural resources, of raw materials, of man power, of time and of money, that goes forth to-day, two of the most conspicuous causes of the newer and more intensive economy, are the war and the oxy-acetylene welding outfit. The former, because it taught plant executives to regard their scrap heaps in a new light and the latter, because it has enabled them to reduce their size to reasonable proportions.

DEVELOPMENTS IN SHOP EQUIPMENT

A NEW COMPENSATED HEAT-METER

Until comparatively recently, the determination of furnace and kiln temperatures by means of thermocouples was attended with complications and difficulties which made practical men impatient, and in some instances doubtful in regard to the intrinsic value and reliability of the method.

Technical men, however, have realized from the beginning that, within certain temperature limitations, the results obtained by the use of thermocouples were not only accurate, but could be made "direct reading," provided that the thermocouple be connected with a galvanometer which would indicate the actual value of the e.m.f. obtained by heating.

On first consideration, this problem did not seem difficult of solution, since it is an established fact that the e.m.f. or voltage of a thermocouple bears a direct relation to the difference in temperature between its hot and cold ends. It is also true that the movable coil of a millivoltmeter will be deflected to an extent which is directly proportional to the e.m.f. of the thermocouple. Therefore it would seem the simplest operation imaginable to connect the thermocouple and the instrument together by means of insulated conductors, figure the scale in temperature values and regard the problem as solved.

Unfortunately, however, we have also to contend with factors which cannot be ignored if accurate results are required; namely, line resistance, thermocouple resistance, and the resistance of the indicator itself, because, to be precise, a direct current millivoltmeter actually is not a millivoltmeter at all, except in name, but is a milliameter or current indicator. All instruments of the d'Arsonval type depend primarily upon current for their operation and the extent of the deflection obtained with any given current is established by the intensity of the magnetic field, the controlling force of the springs, and the number of convolutions or ampere turns in the movable coil, and not by a remote e.m.f. Therefore, if the conductors which carry the current from the source of e.m.f. to the terminals of the instrument do not have a negligible resistance, then, in accordance with Ohms' law there will be an appreciable fall of potential along the line, with the result that the movable system will receive a diminished current and therefore be low in its readings. To reduce such errors to a minimum, it is desirable that the instrument resistance be as high as possible, so that the line and thermocouple resistant may be proportionately insignificant. For instance, if the resistance of the millivoltmeter is 300 ohms, and the resistance of the line (A) and thermocouple (C) is 3 ohms, the current through the circuit will be reduced ½ of 1 per cent. instead of 1 per cent., and the instrument indications will be 1 per cent. low. Figured in degrees Fahrenheit, this would mean an error of approximately 14 deg. in 1400 degs. Fahr. if a thermocouple were used.

The advantage of high-resistance instruments, therefore, becomes evident. For instance, if the pyrometer has a resistance of 600 instead of 300 ohms, and the line resistance remains the same, an error of 3 parts in 600 will result or only ½ of 1 per sent. instead of 1 per cent., or about 7 deg. Fahr. in 1400 deg. Fahr.

Until within the last five years it was customary to use a so-called low resistance pyrometer to measure the current from the thermocouple. These instruments had from 2 to 5 ohms internal resistance and were naturally materially affected by the external resistance of the thermocouple and leads. In the past few years high-resistance pyrometers have been almost universally adopted. These instruments have an internal resistance of usually from 300 to 1200 ohms. The higher the resistance naturally the less effect on the readings due to variations in line resistance, but will increase in internal resistance; something has to be sacrificed, and usually control or torque is weakened. In consequence, the instrument is not as substantial or dead-beat, and, due to the use of lighter springs is more apt to be affected by spring fatigue.

It has been found by trial that an instrument of medium resistance (about 500 ohms) can be produced in a satisfactory and substantial form, but an instrument of this class is necessarily affected in its indications when leads of considerable length are employed. Material variations in the length of thermocouples are also a source of error, as well as the introduction of compensating leads. When compensating leads are employed, as well as long wires, in connecting the thermocouple with the instrument, it is a common practice to reduce the resistance of the instrument in order to offset the effect of line resistance. This is at best a method of doubt-

GENERAL VIEW OF THE HEATMETER.

ful value, since it interferes with checking the scale by comparison with a standard, and does not compensate for changes in the resistance of the line or thermocouple, due to variations in temperature.

Various devices and attachments have been made for use in connection with indicating and recording millivoltmeters and pyrometers, by means of which the instruments will remain direct reading, and at the same time be compensated for external or line resistance. Inventions of this class range all the way from a simple step rheostat connected in series with the "dead" resistor of the instrument, to the elaborate and complicated apparatus employing the substitution and deflection methods, the potential of the thermocouple being first balanced against another potential derived from a dry cell, and after an intermediate operation and on intercomparison of deflections, the effect of line resistance is finally balanced out by means of a rheostat, and direct deflections are obtained from the thermocouple current.

It remained for two physicians, Paul D. Foote and T. R. Harrison, of the Bureau of Standards, Washington, to offer an invention of theirs, which, incorporated in a Brown pyrometer, eliminates the effect of line and thermocouple resistance by means of an operation which is so simple that anybody can use the instrument and obtain accurate results.

This improved heatmeter will unquestionably appeal to the practical man who wants results and does not care especially how the instrument functions provided its indications can be relied upon.

In testing with this apparatus all that is necessary is to connect the thermocouple with the instrument binding posts in the usual manner, press a button, turn a knob, and take a reading, which will be the correct e.m.f. of the thermocouple at its hot end, even if the line is miles in length. In fact the line may have as much as 15 ohms resistance. The Brown Instrument Company, Philadelphia, are the manufacturers of this equipment, and the accompanying illustration shows one form of the complete instrument. As will be seen, the accessory details incorporated into the instrument do not decrease its portability and convenience nor increase its size.

LET'S USE THE RIGHT NAME

Under this peculiar, yet reasonable heading, the Warner & Swasey Co., Cleveland, Ohio, comments as follows:

The name "screw machine" is no longer appropriate when applied to the modern turret lathe. This type of machine is seldom used for the making of screws, as automatic screw machines of various types serve this purpose better when large quantities are involved. The field of the modern turret lathe is as universal at the present time as is that of the engine lathe. Ten years ago bar work was the main product handled on what was then known as a hand-screw machine; but to-day there is more chucking work performed on the turret lathe than bar work. Furthermore, the modern turret lathe is designed and constructed to handle heavy castings and forgings and is provided with sufficient power for machining tough forgings and alloy steel parts. For merely making screws, the present power provided in turret lathes would be entirely superfluous.

While there is a natural reluctance to change a trade name so long used, we have started a campaign for discontinuing the name "screw machine" when applied to the modern turret lathe. We believe that the mechanical world prefers to call a machine by a name which describes the field for which it is intended —a name that it has acquired by evolution into a larger field, rather than a name designating the field occupied years ago. The screw machine of yesterday is the turret lathe of to-day, and we take this opportunity of urging all users and manufacturers to aid in the campaign for dropping the old term "screw machine" when applied to turret lathes.

NEW THINGS IN MACHINE TOOLS

The Sibley Machine Company of South Bend, Ind., are now manufacturing two new sizes of drill presses, similar in design to their 24-inch sliding head machine.

* * *

The Grand Rapids Grinding Machine Company has designed a grinding machine for grinding the tapers on the ends of taps. It is adjustable for right or left-hand taps, and likewise for long or short tapers.

* * *

The Norling Rotary Engine Company of Chicago, has recently perfected a self-locking one-ton straight-line chain hoist, which combines the four good qualities of simplicity, safety, durability and light weight.

* * *

Pneumatic motor hoists in capacities up to 2 tons are now being made by the Independent Pneumatic Tool Company of Chicago. The speed lift is 32, 16, and 8 feet, respectively, for the ½, 1 and 2 ton sizes.

* * *

A very serviceable punch, which may be used either for hand or bench work on 20-gauge or less, and up to a half-inch hole, has been placed on the market by the Parker Supply Company of New York. The total weight of the machine is 4½ pounds.

* * *

An automatic temperature regulator has recently been placed on the market by Charles Engelhard, 30 Church Street, New York. By means of a motor and suitable gearing a slotted link, adjustable to different strokes, is caused to oscillate, and by the action of two electro magnets in circuit with a pyrometer, a shaft is revolved in one direction or the other, depending on the magnet in action, so that the control valve may be opened or closed according to the temperature desired.

* * *

Among the many tools that Alfred Herbert, Ltd., of Coventry, Eng., placed on the American market recently, are a universal turret lathe, a heavy duty combination turret machine, and a special heavy-duty slotter. The turret lathe, which is known as the No. 4, is designed for both bar and chuck work. The spindle has a hole for 2-inch stock, and has a range of eight speeds. Four automatic feeds are provided. The hexagon turret may be rotated automatically or by hand. Adjustable stops for each position of the turret are likewise provided; they act as dead stops in addition to tripping the feeds. The heavy combination turret machine is made in three sizes, the two larger provided with sixteen changes of speed. The turret slide apron is fitted with reverse feeds so that the cutting tools may be operated in either direction. The spindle holes are for 2¾, 3½ and 4½-inch stock respectively. Net weights are 5,280 lbs., 6,680 lbs., and 11,050 lbs. The Muir slotting machine is designed for exceptionally heavy service, and is particularly recommended for crank web work, and work beyond the economic scope of the ordinary milling machine. These slotters are made in four sizes, ranging from 8½ to 18-inch maximum stroke, with table diameters of from 27 to 42 inches.

NEW CATALOGUE

The Geo. F. Foss Machinery and Supply Company, of Montreal, has just issued an elaborate and well-arranged catalogue, containing 1,300 pages, exclusive of index, the latter occupying about 50 pages. The book is profusely illustrated with cuts and diagrams. A prominent feature of this catalogue is the arrangement of the various lines and the systematic grouping of the different articles. The illustrations on a given page are designated by the same number, being distinguished from each other by the addition of different letters. A special index has been devised for locating all articles described and instantaneous reference is practically assured. A considerable section in the back of the book is devoted to useful and valuable information.

The iron deposits at Boisdale, Cape Breton, Nova Scotia, are being opened up by the Dominion Steel Corporation in order to determine the quality and quantity of the ore. At the present time it is understood that fully 10,000,000 tons are in sight, and it is believed that this is not by any means the full extent of the deposit.

Stretcher Waggon of Unique and Simple Design

By George Laidler

NEARLY every large industrial plant has its hospital or first aid department. With the increasing size of plants it is important that there should be provided a ready means of conveying an injured employee from any part of the works to the works' hospital or first aid post.

The ordinary hospital type of wheeled stretcher is too delicate and expensive for factory or outdoor use. To meet its own needs one firm has devised the simple vehicle shown on the accompanying drawings, to accommodate a standard stretcher. The stretcher vehicle is kept at the works' hospital.

At certain well-known points where a telephone is available (usually foremen's offices) stretchers are placed in readiness. In case of accident a message to the hospital causes the vehicle to be hurried to the scene. Meanwhile the local stretcher has been taken to the injured employee, and when the vehicle arrives, or is met by its bearers, the patient is carefully wheeled to the medical man, without the inconvenience of transferring the sufferer from the original stretcher.

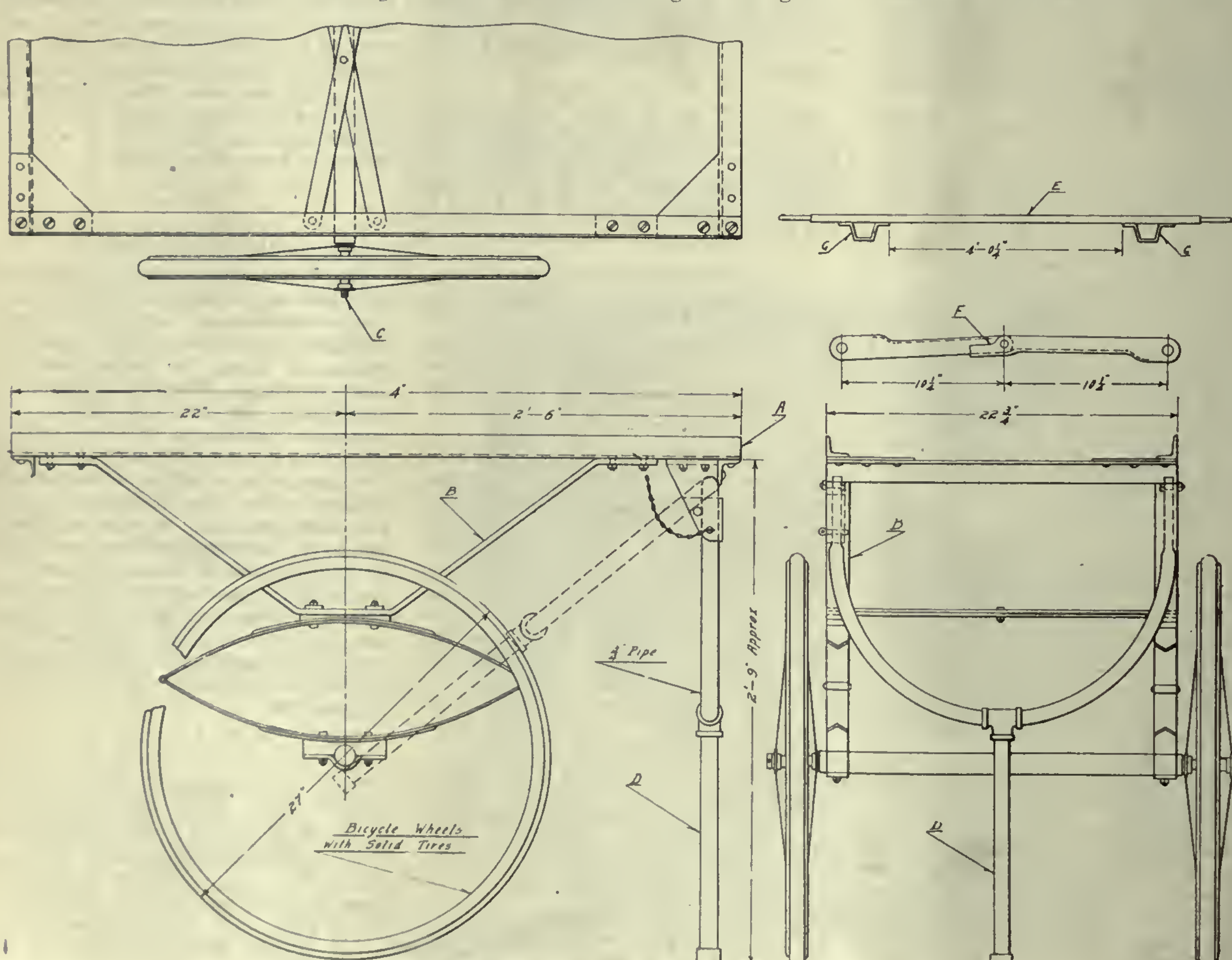
In construction, the gussetted frame A of light angles is arranged to take the stretcher easily. A cross-braced underframe B flat bar rests upon two springs such as are sold for wagon seats. These in turn rest on hardwood blocks which are held to the tubular axle by bolted straps. The wheels are of the common bicycle type, with solid rubber tires one inch diameter. Pneumatic tires are unsuitable as they are liable to be punctured or to be found deflated when suddenly a call comes. For strength and simplicity the standard cycle spindle with ball bearings is replaced by a parallel pin C with a flanged end, which is driven into the inch pipe axle and pinned.

The hinged leg D consists of a pipe with a cap, joined by a tee to a semicircular member with flattened ends. These ends are attached to a knee of bent plate bolted to the frame. When down, the leg is rigidly held by a chained pin passing through bent plate and flattened pipe, on one side of the vehicle only. When in motion the leg is swung towards the axle and kept there by inserting the pin in another hole.

The stretcher E consists of stout canvas over hardwood side pieces. When opened, hinged arms of inch angle interlock in a position beyond the dead centre. (See detail F). The iron brackets G serve to keep the canvas above the floor or ground, and also to prevent end play when the stretcher is placed on the vehicle. The end straps are for fastening the stretcher when rolled up, and the central strap is long enough to encircle a patient who might be violent, as in a fit.

The cost of labor and material for one vehicle and twelve stretchers as described amounted to $125.

A plate-bending roll which has recently been made in America is claimed by the makers to be one of the largest ever turned. It is 35 ft. 6 in. by 3 in. in the body, 40 feet 8 inches overall, and weighs 60 tons. The ingot from which it was forged weighed 119 tons, and was 67 inches in diameter.



DETAILED VIEW OF THE STRETCHER WAGGON.

Intricate Welding of Aluminum Crank Case

It is Often Surprising What Can Actually be Accomplished by the Welding Process—This Description From "Acetylene and Welding Journal" Shows Some Wonderful Work on an Aluminum Crank Case

THE accompanying photographs which show an aluminium crank-case before and after repair by the oxy-acetylene process, demonstrates that no matter how bad the damage may appear, and in this case the casting was broken into twenty-seven pieces—it was also badly cracked and several parts were missing—it is possible to repair it provided that technical skill and ingenuity are used.

Aluminium as a material for casting presents many advantages on the score of lightness and strength, and the enormous number of aluminium castings which are now employed in aeronautical, automobile, and other classes of work opens up a wide field for the application of the oxy-acetylene process for the repair and alteration of such castings.

Pure aluminium is not usually employed for castings subjected to stress, owing to its comparative softness and lack of strength. In order to raise the tensile strength and increase the hardness it is usual to add small percentage of some hardening metal, such as zinc, copper, nickel, etc., the amount and nature of the added metals depending upon the physical and mechanical properties desired. There are two main classes of aluminium casting alloys; those containing zinc (either with or without the addition of small quantities of other metals) and those containing copper as their principal hardening medium. The extensive researches of the British Aluminium Company, Ltd., into the properties of aluminium alloys have enabled them to select and standardize a number of alloys. These alloys are supplied in the form of a notched ingot weighing about 6 lbs.

In the case of new castings, shrink-holes, pinholes, and other surface defects may be repaired in a very satisfactory manner with the oxy-acetylene blowpipe, and the casting thus repaired is quite as strong and reliable as one cast perfectly. After the repaired portion is cleaned up and any excess metal removed it should be impossible to distinguish the welded part from the rest of the casting.

A suitable alloy for crank-cases consists of zinc, about 13 per cent., copper about 2½ per cent., and the remainder aluminium.

The success of welding aluminium castings by the oxy-acetylene process depends to a great extent upon the skill and intelligence of the operator. The average aluminium casting is somewhat complicated in its design, hence the necessity for skill in carrying the work through, especially during the preliminary portion. An expert in aluminium welding is distinguished by the careful preparation of the work, the arranging of supports, chills, temporary moulds, etc.; the sound judgment as to whether total or partial preheating is necessary; the choice of a correct size and well-designed blowpipe; the adjustment and maintenance of the correct proportions of oxygen and acetylene. In this connection many writers still recommend the use of excess acetylene in the flame in order to prevent oxidation and reduce the temperature of the flame. With well designed and a good range of blowpipes this is not necessary. It is essential, and the expert will pay attention to this, that the oxygen and acetylene should be very pure; aluminium absorbs nitrogen if present as an impurity in the oxygen and other gases and the presence of these will render the welds porous, brittle and unreliable. Dexterity in manipulating the flame so as to avoid deformation and rapidity and ease of operation are essential if overheated and damaged welds are to be avoided.

THE CYLINDER AFTER WELDING.

A first-class aluminium flux is a great advantage and a skilled operator has no difficulty in determining the relative merits of fluxes. The welding rod should be of practically the same composition as the casting, pure rod should not be used and for crank-case repairs rods of about half inch diameter, which are difficult to obtain, are a distinct advantage. The rods in common use at the present time are usually too short and too small in diameter. Since aluminium alloys have a low melting point, high conductivity for heat, and become fragile previous to fusion, preheating and cooling must be carried out very carefully.

The use of a flux on aluminium castings has been abandoned by many welders. In place of it they break down and remove the oxide by means of an iron

Continued on page 62

THE CYLINDER AS IT APPEARED BEFORE WELDING.

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PRINCIPAL CONTENTS

Daylight Saving Muddle

DAYLIGHT saving is meeting with an indifferent reception this season. Places that had it last year are staying with the clock this year, and letting the sun and the moon alone.

It suits some families, and others find that it does not work to their advantage at all. The result is that we have this year a splendid example of hit-and-miss time all over the country.

This country has had some years of experience with this sort of thing now, and those who have been benefited are a minority when compared with those who have found the new idea a nuisance and a drawback.

And so we have the spectacle of railroads running on old time through places on new time: Toronto on new time and Hamilton and places in between the two on old time.

The whole thing as it stands is a mess.

Put the hands of the clock where they properly belong and quit tinkering.

Just Half the Truth

SERIOUS mischief often comes to pass from some hot-head grabbing a half-truth and making use of it.

For instance a little book published by radical printers in United States has this:—

The day operator, working for the scale and producing 28,000 ems of eight-point type (which, according to the scale of prices, is a fair day's work), receives a few cents over $7. The employer, according to the schedule of rates of the composition association (which we understand has recently been revised upward), receives for this 28,000 type $21. On a weekly basis this means that the operator receives $42 and the employer $126.

Do the above figures make you feel contented and perfectly satisfied with the present scale? Whisper your answer so you will not be overheard by the Bolshevik raiding crew.

Yes, we get you, Steve. We agree with you.

Facts were at once brought out to nail this mischief maker, and it was shown that the business under review has made profits of about 6.8 per cent.

The figures were from the books of chartered accountants in Chicago who audited the firm's business.

The agitator is always ready to pick up half-baked figures, odds and ends that are miserably deceptive, and out of these patch up material with which to harangue and distort.

The wise employer will fight figures with real figures, and falsehoods with absolute, sworn-to if necessary, statements of actual conditions.

Declining Steel Inquiries

THERE has been a perceptible falling-off in inquiries for steel during the past month. It may be that part of this is due to the fact that people become weary of asking for things they cannot get, but that will not explain it all.

The most likely explanation is that buyers are getting weary of paying two or three prices for everything they take into stock, and unless they must buy to avoid a close-down, they are out to stay until there are more signs of sanity in steel prices.

For instance a salesman dropped into Toronto this week with the information that he had a fair tonnage of black sheets at 8 cents per pound. He found several firms ready to talk business. These warehouses have to add their profit, which will mean, exchange added, a re-sale price of around 10 cents to the consumer in Canada for black sheets.

There are firms that must have black sheets or go out of business, and for this reason they pay through the nose. It is not correct to say they are willing to pay these prices. They pay them because they have to pay them or close up shop.

To get some idea of the average prices for sheets at Pittsburgh, take the five years 1910 to 1914 inclusive, and the prices will average this way:

Year	Per Ton
1910	$45.80
1911	40.60
1912	40.00
1913	44.00
1914	37.80
1920	87.00

Prices for Canada are not always regarded as domestic business by United States mills. The recently announced schedule of the American Sheet and Tin Plate at Pittsburgh was 4.35. Add one cent per pound, or $20 a ton for Canada and we have $100.70 per ton. Freight, duty, exchange added will put the Canadian user in for a sheet that will cost him around 7.35 without any profit for a dealer. When you get into the premium class and start 2.65 per pound higher than the Canadian price from the Steel Corporation, and add the profits of a dealer here on the basis of the increased capital necessary to handle the stuff, you are going to have an article that will cost the Canadian buyer around $240.00 per ton.

How is the Canadian manufacturer going to turn out material to compete with articles made in United States under such conditions?

The result is to be seen in the falling off of the demand in the steel trade. It does not mean that there is not a demand and a scarcity for steel. Rather, the real interpretation is that buyers are dropping off unless for absolutely vital supplies, until such time as some of the premium brokers get off the map.

TRANSPORTATION HAS BEEN THE ONE REAL PROBLEM

And Traffic Has Increased With Much Greater Speed Than the Cars to Take Care of It

By E. A. McCARTHY, Hyatt Roller Bearing Co.

DURING the past winter I have seen office men of mediocre physique spend night after night in various railroad switching yards out in the snow and rain to make sure that their shipments were moved. I have seen these same men roll up their sleeves alongside freight handlers and help transfer stuff from one car to another. I have seen farm tractors do switching work day after day—switching that technically was the duty of the railroads. I have known manufacturers to send men across several states to get a trunk or a suit case full of parts to be used for completing machines—machines that were often sold at a loss.

One Michigan manufacturer, within the next few weeks, will begin operating a fleet of trucks between his factory and his sources of supply—in some instances a distance of over 700 miles!

In our own organization every man who has visited our factory during the past six months has been instructed to bring back as many bearings as he could carry as baggage.

During the express handlers' strikes over half of our office force went down into the railroad yards and spent day after day—sometimes far into the night, unloading express cars containing our product in order to expedite deliveries to our customers.

It is hard for the public to realize just how many difficulties have beset the manufacturer in making deliveries during the past two years. Never before have so many different obstacles had to be overcome.

Although on every hand we hear cries of greater production, I believe that a thorough analysis would convince anyone that it is more a question of transportation, for even with disturbed labor conditions the majority of delays in manufacturing can be traced directly or indirectly to delays in transporting material.

During the past three years transportation has been the "neck of the bottle." No one has been free from the effects. The manufacturer has been delayed in getting his material. He is dependent upon the steel mills and the parts makers, and they in turn are dependent upon the mines, and then again the mines are dependent on other manufacturers for mining equipment with which to operate.

The farmer is dependent on many phases of the manufacturing industry to supply his needs and absolutely everyone is directly dependent upon the farmer.

Thus we get an endless circle of dependencies and analyzing the situation from its various angles the wonder is that things are moving along as smoothly as they are.

Since 1915 the volume of freight handled in this country has increased 45 per cent. During the same period the increase in number of freight cars amounts to only 2 per cent.!

This deficiency in freight car equipment is seen reflected in express service: when a shipper realizes the congested freight condition he routes more and more of his goods by express.

As a result of this condition express shipments have increased more rapidly than ever before. Few express cars have been built during the past three years. To-day it is quite the practice to ship commodities by express that under normal conditions would have always gone by freight. This has been a substantial factor in increasing prices.

The railroads are the arteries through which the very life blood of the nation flows. These arteries are hardened, they no longer expand, the blood pressure is high. Goods cannot be freely transported from one section of the country to another and as a result of this our whole industrial system is out of joint.

The only way to compensate for the deficiency is to speed the flow of products through the available channels. It is up to the traffic men—both with the railroads and with private corporations to accomplish this.

It is a "man's size job." It is an unending job. Conditions are serious—if we give up to them they will immediately become disastrous!

More work, more thought and less talk are needed. High-brow legislation will not change the economic condition. The problem is practical rather than political. We have no time to spend in proving who is to blame. It's a question of making the best of things by putting forth constructive effort and real "sweat."

Speaking of Gardening

ABOUT this time most every year when bullfrogs make a sound, men get a hankerin' in their souls to gouge into the ground, and there to plant a seed or two, or stretch 'em in a row, and wield a shovel and a rake to coax the truck to grow.

Ah! Well, I mind when once I went and bought a rake and spade, likewise a hoe, the slickest thing a man had ever made. I got a shovel and a trowel, wheelbarrow and a line, and reckoned in the winter on spuds and beans we'd dine.

The outfit cost me seven bones, stripped from my fading wad, before I ever made a hole or turned the thistled sod.

Tomato plants and radishes, cucumbers, onions too, I stuck in carrots, beets and corn—the plot was ten by two.

Whene'er I saw a weed in there I got the spade and hoe, and said you evil sproutin' thing from this here place you go. It was a joy unto my eye to see the green stuff sprout, until the slugs and bugs and lice began to look and shout, and tell their friends about my stuff, about my tender shoots, and while I tinkered on the top they tinkered at the roots.

Tomatoes were a bilious hue, the worms they weighed a pound, they got their fists clenched for a scrap whene'er I came around; the lice they swiped the radishes, they riddled them right through, I had six carrots from the wreck to figure in a stew.

My garden was a mess all right, old Hicost stayed with me, I'd reckoned to have chased that prune into some lofty tree.

But every time when spring comes round I grab my rake and hoe, and out on my ten feet of earth I start to make a show. I know I aint no gardener, but then, by heck, it's nice, for easy marks like me to feed tomato worms and lice.—Ark.

THE overall fad and the strike against using potatoes fell asleep at the side of the road. One reliable report has it that Old Man Hicost ran over them with his cart.

* * *

IN THE machinery, iron and steel world just now, it is one thing to buy goods, and quite another to receive them.

* * *

THE Germans now say that the Kaiser lost the war, and they were prepared to can him early in 1918. All these postmortems are wasted time and energy. The fact is that had the war been going well the Kaiser would have been regarded as a dandy. Nothing succeeds like success, and nothing is so unpopular as a failure.

* * *

A NORWEGIAN astronomer has discovered that the real color of the sky is black, and not blue. A man who has eaten a dollar meal and found he had 50 cents to pay for it has made the same discovery.

MARKET DEVELOPMENTS

Shipping is a Serious Matter for the Trade Now

Embargo Against Many Points is Still On—Many Orders Have Left the Mills in States, But There is No Trace of Them Yet—Falling Off in Steel Inquiries Noticed

THE steel warehouse trade in Toronto is of the opinion that there has been a falling off in the number and extent of the inquiries, as compared with a month or six weeks ago. Their volume of business is still satisfactory, and their accounts are in splendid shape, but the fact remains that some of the insistence has left the market. High prices and the operations of the premium brokers and mills may have something to do with this, as it is not likely that any consumer would buy a pound more of premium material than he had to have to keep the doors of his shop open. The distance between Steel Corporation prices and those asked by premium brokers is very marked, and business inquiries are dropping off as a result.

The strike is a much more serious matter than is generally recognized. Firms in Canada are having serious times trying to get cars from U.S. points. Embargoes are holding back materials that are absolutely necessary to the operation of plants. There are cases where shipments of boiler tubes, for instance, left the mills at the end of March, and have not been heard of since either by customer or shipper.

The machine tool trade believes there is a lot of business in the country that will come out later on, viz., the replacement selling. Firms wanting to replace old equipment have stayed out of the market on account of long and indifferent deliveries and the high prices. This booking will all come in due season, and makes a nice reserve in the way of business for the future.

The scrap trade continues stagnant. The embargo is still on and trading is confined to Canada. The demand here is not brisk. Prices, though, have not suffered, and are still quoted at the rates prevailing a couple of months ago.

TIRED ORDERING AND NOT GETTING

That May Account for Some of the Falling Off in Inquiries in Steel Market.

TORONTO—The steel trade reports that inquiries have fallen off as compared with a month ago, but they will not state that the sales have sagged a great deal. It may be that some of the buyers have become wearied of asking for material which they have been unable to secure, and a supply and some definite promise of delivery might do much to bring them back into the market.

The railroad troubles in United States have played havoc with deliveries. The representatives of one of the large machine tool plants was in Toronto today, and speaking with this paper stated that during the past month the deliveries they had been able to make amounted to some $20,000. The rest of the material was piled and stored waiting for some betterment in the shipping situation.

There are several views on the machine tool situation that have value as causing people to think. "There are a number of plants," stated one dealer, "where they have put in a lot of money in plant and equipment. They have been held back by a hundred and one things from getting production on a paying basis. It is necessary for them to stay in the market and keep on buying in order to get production to the point where their money will start to come back. It is very natural that they should wish to reach this point while their selling values are still at the high mark.

The Resale Market Still Here

"Then there is the re-sale market for machinery. By that we mean the taking in of machinery for the purpose of replacing tools that are either worn out or out of date. That market is still here, and it is going to be a good one when some of this special business gets attended to. There are plenty of places that are doing what people are, viz., making the old stuff do. This business is piling up, and a certain amount of it is forced into the market every now and then by necessity, but there is a lot of it that has not come and it forms a very nice reserve for the future."

"We are certainly placing no orders for stock," stated one dealer to-day. "A good many of the makers of machinery are enforcing the non-cancellation clause again. We will order only against a certain and definite sale."

Demand is Falling Off

Inquiry has fallen off in the steel market in the past few days. That is the consensus of opinion of several dealers. The month of April was an exceptionally good one. The steel trade is in good shape here, though, for whatever happens. One manager stated that he was certain they did not have $1,500 on their books now, and all of this, he thought, could be gathered up in a short time were it necessary. Others report the same state of the market. "We can't slump," laughed one of the steel merchants when speaking of the matter, "for the very good reason that there is hardly anything in our warehouse to slump on." He went on to state that the reason for Japan's trouble financially now has been the high prices they have been paying for all classes of steel material. Every agency from the commission man, jobber, through to the user, is stuck with high priced material there. Canada has not sinned in this regard. We have paid higher prices than ordinary because we have had to do it."

Premium dealers are booking more business in Toronto this week. A good tonnage of black sheets went at 8½ cents f.o.b. United States points, and that will mean a pretty fair advance when the material passes out of the warehouses here.

A representative of one of the largest steel mills who was in Toronto this week stated that he had seen hardly a single freight car moving between Pittsburgh and Buffalo. Shipments for this district are very bad, and not a few manufacturers are in bad straits waiting for some material in order to finish up and release a lot of goods that have a more or less seasonable sale. In one case a large number of gas engines are waiting for a few parts to let them out.

One Toronto firm ordered 150 tons of boiler tubes, and were delighted with the manner that the first two cars got over the border. That would account for about 60 tons. Since then they have heard nothing of them. The rest of the shipment is either caught in the embargo or lost.

A number of shipments were started from U. S. points at the end of March. Where are they? No person seems to know. Efforts that have been made to trace them have not been successful.

The Scrap Trade is Quiet

Dealers are inclined to blame the embargoes for the unusual dullness that has settled down on the scrap metal trade. Any business that is carried on is confined of necessity to Canada. The reds and yellows are very dull, and about all the trading that is being done is being held for future delivery or speculation. The demand for iron and steel is not very insistent or pressing. It is possible to get orders filled now for a fairly wide range of wanted materials, although there is still room for a holder of stove plate, cast scrap or heavy melting to get a hearing in the market at a good figure. Prices are not being changed yet, although it is easy to see that there is a weaker feeling in the market.

GERMAN TOOLS NOT IN MUCH FAVOR

At Least That Is the Report That Comes from Germans Out to Make Investigation.

Special to CANADIAN MACHINERY.

NEW YORK, May 13.—Improvement in railroad transportation has brought a better feeling in the machine-tool trade. Some plants are now making shipments for the first time in weeks. Locally the demand for machine tools has fallen off in the past week, but it is not to be expected that buying in volume would continue under the uncertain conditions which prevail.

The Norfolk & Western Railroad has not yet begun placing orders against the list issued a couple of weeks ago, but it is understood these orders, amounting to hundreds of thousands of dollars' worth of shop equipment, will be forthcoming soon. The Long Island Railroad has inquired for a few tools. The General Electric Co. is again in the market for tools. Aside from some of the large automobile companies, the General Electric Co. has probably been the largest buyer of machine tools in the United States during the past year. A new list has been issued for the recently acquired plant at Bridgeport, Conn. About 15 milling machines, eight shapers, several grinders and other tools are required. Some of the equipment recently bought for the Bridgeport plant was diverted to the new Baltimore, Md., plant. The Simms Magneto Co., East Orange, N. J., has purchased additional tools, its purchases in the past several weeks having been fairly large. The Van Sicklen Speedometer Co., Newark, N. J., and Toledo, Ohio, has cancelled some of its recently-placed orders, as it will not make magnetos, but will confine its production to speedometers. The S. S. White Dental Mfg. Co., Staten Island, has bought several tools.

Export trade is not notably large, but some business is coming through, notably from England. It is stated that the automobile manufacturers there will copy American production methods to some extent, and are seeking American production tools. Multiple spindle drills and milling machines are particularly in demand. A newspaper dispatch from Berlin, Germany, quotes a letter written from London by the leading member of a German committee which was sent to England to foster trade relations between Great Britain and Germany, in which it was stated that owing to the huge quantities of American machine tools with which England has been flooded during and since the war the latter country offers small encouragement to German manufacturers of machine tools. "These American tools," he writes, "are of excellent quality and made to the English foot and inch measure. For that reason they are preferred. Moreover, English workmen still have strong objection to tools of German make. The German manufacturer must have patience."

One of the largest export inquiries before the trade is from Anderson, Meyer & Co., 80 Wall street, New York, an export concern, which wants about 30 tools for shipment to China.

THE RAILROAD STRIKE IS WORSE THAN HAS BEEN GENERALLY STATED

Special to CANADIAN MACHINERY.

PITTSBURG, May 13.—Pig iron production in April, curtailed by the rail strike, was at the rate of about 33,650,000 gross tons a year, or at 75 per cent. of capacity, if capacity be estimated at 45,000,000 tons a year, and that seems to be a fair estimate, though possibly it may be found to be a trifle low, if favorable manufacturing conditions, like those obtaining before the war, ever return. The March rate had been 90 per cent. of capacity, and as the rail strike did not apply to the entire month of April it is evident that when the strike was at its worst the rate of pig iron production was more than one-sixth off from the March rate. Had it not been for the strike production would probably have increased, since all the trends were in that direction. The production of steel was probably affected by the rail strike in about the same manner as was the production of pig iron. The April steel ingot report of the American Iron and Steel Institute should appear in a few days and will permit of an exact comparison being made.

Production of pig iron and steel has continued to grow, although at a rather slow rate. Among producers there is a disposition to complain that reports as to the rail strike waning are altogether too favorable, that the strike is still very bad, but on the other hand one can observe also that the producing trade has a disposition to magnify the effects of the strike upon production, by not making sufficient allowance, in the general average, for the plants that are working practically full. Thus the South and East are scarcely affected at all, and some of the plants on the lake front are doing quite well, almost normal. The Youngstown district, the one most affected, seems to be producing at more than half capacity, while the immediate Pittsburgh district is probably doing better than 80 per cent.

Trainload Movements.

In the territory affected by the strike, most of the freight movement in connection with the iron and steel industry is of the solid trainload variety. Such coal and coke as reached the Youngstown district, for illustration, is altogether by trainloads, direct from coal mines in the case of coal, and from yards in the Connellsville region in the case of coke. Inasmuch as it is much more difficult to make up solid trainloads of finished steel products, the movement out of works is smaller than the movement of raw materials to works, and thus, in the main, steel is accumulating at mills. There are a few large consumers who can take entire trainloads of steel, but the ordinary consumer cannot. There has been some movement of trainloads to Western classification yards, whence individual cars are dispatched to Western consumers. Permits to ship carloads are obtainable with slightly more ease than a week ago, and a few districts have had their embargoes entirely removed. There is the further difficulty that car supplies for loading are very poor.

Steel consumers are affected not only by not receiving steel, but also by not receiving coal and other necessities. In Detroit, for instance, the lack of coal is greater than the lack of steel, and factory operations in that district are now probably below 50 per cent. of normal. On the whole it would seem that the consumption of steel is curtailed more than the production, and the balance of probability is that when the strike is over steel will reach consumers in large

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$42 40
Lake Superior, charcoal, Chicago	57 00
Standard low phos., Philadelphia	50 00
Bessemer, Pittsburgh	43 00
Basic, Valley furnace	42 90
Toronto price:—	
Silicon, 2.25% to 2.75%	52 00
No. 2 Foundry, 1.75 to 2.25%	50 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 50
Steel bars, base, Toronto	5 50
Iron bars, base, Montreal	5 50
Steel bars, base, Montreal	5 50
Reinforcing bars, base	5 00
Steel hoops	7 00
Norway iron	11 00
Tire steel	5 75
Spring steel	10 00
Band steel, No. 10 gauge and 3-16 in. base	6 00
Chequered floor plate, 3-16 in.	9 40
Chequered floor plate, ¼ in.	9 00
Staybolt iron	9 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	4 00
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 90
Small shapes under 3"	3 62

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

	Gross. Montreal	Toronto
Lake copper	$25 00	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	72 00	75 00
Spelter	12 00	12 25
Lead	11 50	12 00
Antimony	14 50	14 00
Aluminum	34 00	35 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 7 25	$ 7 25
Plates, ¼ up	6 50	6 50

PIPE—WROUGHT

Price List No. 44—April, 1920.

STANDARD BUTTWELD S/C

	Steel Black	Steel Galv.	Gen. Wrot. Iron Black	Gen. Wrot. Iron Galv.
⅛ in.	$6 50	$ 8 50	....	....
¼ in.	6 18	7 26	$ 5 48	$ 7 56
⅜ in.	6 13	7 26	6 48	7 56
½ in.	6 84	8 42	7 27	8 84
¾ in.	8 45	10 58	9 03	11 18
1 in.	12 50	15 64	13 35	16 49
1¼ in.	15 91	21 15	18 06	22 31
1½ in.	20 21	25 30	21 59	26 68
2 in.	27 20	34 04	29 05	35 89
2½ in.	43 00	53 82	....	....
3 in.	56 23	70 38	....	....
3½ in.	71 30	88 32	....	....
4 in.	84 48	104 64	....	....

STANDARD LAPWELD S/C

	Steel Black	Steel Galv.	Gen. Wrot. Iron Black	Gen. Wrot. Iron Galv.
2 in.	$30 90	$37 74	$34 60	$41 44
2½ in.	45 34	56 15	51 19	62 01
3 in.	59 29	73 44	65 94	81 09
3½ in.	73 14	90 16	82 34	99 85
4 in.	85 55	106 82	97 55	117 72
4½ in.	0 98	1 23	1 24	1 49
5 in.	1 15	1 44	1 44	1 78
6½ in.	1 49	1 86	1 87	2 25
7 in.	1 94	2 43	2 42	2 90
8-L in.	2 04	2 65	2 54	3 05
8 in.	2 35	2 94	2 92	3 51
9 in.	2 81	3 52	3 50	4 21
10-L in.	2 61	3 25	3 25	3 90
10 in.	3 35	4 20	4 18	5 03

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.

4½" and larger 50%.

4" and under, running thread, 30%.

Standard couplings, 4-in. and under, 30%

Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$15 00	$14 00
Copper, crucible	18 00	18 00
Copper, heavy	18 00	18 00
Copper wire	18 00	18.00
No. 1 machine composition	16 00	17 00
New brass cuttings	11 00	11 75
Red brass cuttings	14 00	15 75
Yellow brass turnings	8 50	9 50
Light brass	6 50	7 00
Medium brass	8 00	7 75
Scrap zinc	6 50	6 00
Heavy lead	7 00	7 75
Tea lead	4 50	5 00
Aluminum	19 00	20 00
	Per Ton	Gross
Heavy melting steel	18 00	18 00
Boiler plate	15 50	15 00
Axles (wrought iron)	22 00	20 00
Rails (scrap)	18 00	18 00
Malleable scrap	25 00	25 00
No. 1 machine east iron	32 00	33 00
Pipe, wrought	12 00	12 00
Car wheel	26 00	26 00
Steel axles	22 00	20 00
Mach. shop turnings	11 00	11 00
Stove plate	26 50	25 00
Cast boring	12 00	12 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜-in. and less	10
Carriage bolts, 7-16 and up	Net
Coach and lag screws	25
Stove bolts	55
Wrought washers	45
Elevator bolts	Net
Machine bolts, 7/16 and over	Net
Machine bolts, ⅜-in. and less	15
Blank bolts	Net
Bolt ends	Net
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square, blank	add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 50
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent.
Set screws	25 and 5
Sq. and hex. hd. cap screws	22½
Rd. and fil. hd. cap screws... plus	17½
Flat but. hd. cap screws .. plus	30
Fin. and semi-fin. nuts up to 1-in.	20
Fin. and Semi-fin. nuts, over 1 in., up to 1½-in.	10
Fin. and Semi-fin. nuts over 1½ in., up to 2-in.	Net
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$60 00
Open-hearth billets	60 00
O.H. sheet bars	76 00
Forging billets	56 00-75 00
Wire rods	52 00-70 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 70
Cut nails	5 85
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¾
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 35½
British Manila rope	0 28
New Zealand hemp	0 28
Transmission rope, Manila	0 47
Cotton rope, ¼-in. and up	0 88

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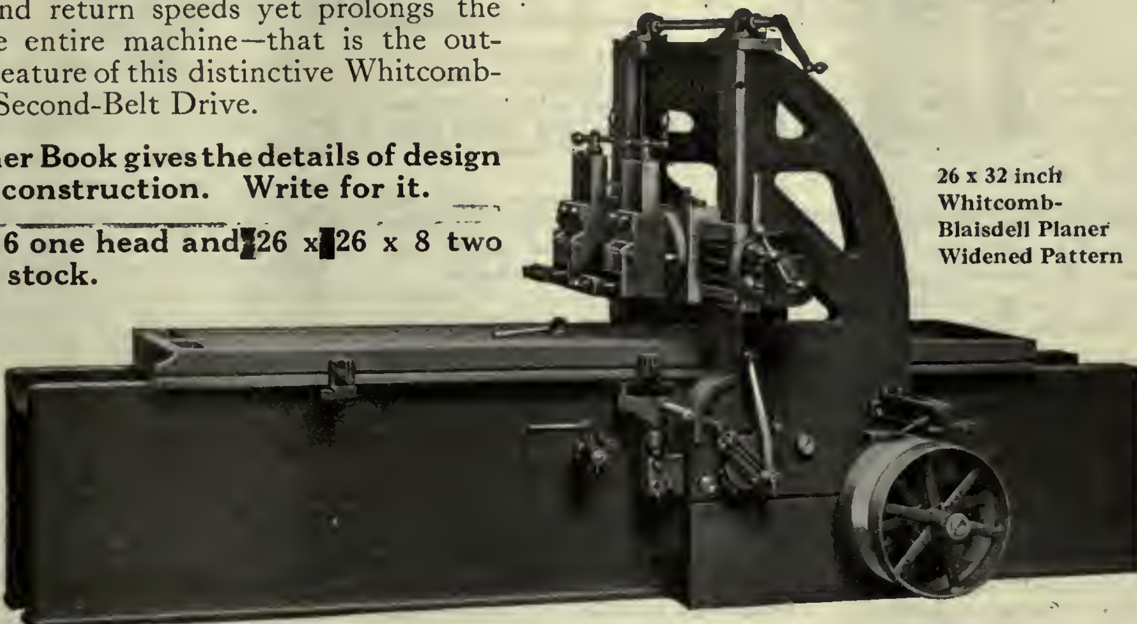
The Planer With the Second-Belt Drive

A smooth, easy reverse—which permits higher cutting and return speeds yet prolongs the life of the entire machine—that is the outstanding feature of this distinctive Whitcomb-Blaisdell Second-Belt Drive.

Our Planer Book gives the details of design and construction. Write for it.

24 x 24 x 6 one head and 26 x 26 x 8 two heads in stock.



26 x 32 inch Whitcomb-Blaisdell Planer Widened Pattern

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quantities, perhaps uncomfortable quantities in some instances.

Steel Shortage

Whatever shortage in steel exists now is due to transportation conditions. There is a new situation. The market is no longer wholly in favor of the sellers and as trends are now it may be only a short time until the market is wholly in favor of buyers. The fancy premiums recently obtained so readily for prompt shipments are melting away. One cannot buy much steel for early delivery, but that is on account of transportation conditions. When it becomes possible to move steel freely there will not be much tonnage demand at the highest prices.

There is an easier situation as to moderately forward deliveries, such as are made by the larger independent producers, but this has not resulted in much price decline, at least thus far. The mills are maintaining their prices, except perhaps when a particularly desirable contract for extended deliveries is offered. The policy is to maintain prices, even though current sales are considerably less than current production, as larger sales could hardly be made by reducing prices. The mills have enough business on books to carry them comfortably for a while yet and feel that there is no occasion to make price concessions until they are forced to do so in order to maintain operations.

There is a question, indeed, whether some of the mills would not prefer that there be a period of slack operation, for the purpose of reducing production costs, and particularly of showing labor that jobs are not guaranteed to be of indefinite life at whatever wages are asked and irrespective of the amount of work done to earn the wages. The feeling has been growing rapidly of late in banking and manufacturing circles that the country needs a readjustment before it can be really prosperous, a readjustment that will make everybody willing and really anxious to work and will bring down the cost of living.

Coke and Pig Iron.

The increase in opportunity to ship foundry coke noted in last report has not continued, chiefly because car supplies have become poorer instead of increasing further. The blast furnaces have much less difficulty than the foundries, since Connellsville coke is moving through to blast furnaces in solid trainloads, and when the cars are unloaded the empties go straight back. Foundry coke, on the other hand, is shipped in single carloads, and many regions are entirely closed by embargo, although occasionally a shipping permit can be secured in the case of embargoed territory. Prompt Connellsville coke has gone up $1 a ton on both furnace and foundry, being now quoted strong at $12 for furnace and $13 for foundry, per et ton at ovens. Foundry coke on contracts beginning July 1 is held at $11 to $12, depending on grade and reputation.

There is considerable discussion as to the extent to which the consumption of foundry iron is being curtailed by the strike, and particularly as to the relation the consumption now bears to the production. The balance of probability is that consumption is curtailed more than production. Many furnaces are piling iron, some of them practically their entire make. The spot most affected by the rail strike, the Mahoning valley, produces hardly any foundry iron, the furnaces there being attached to steel works with only one or two exceptions.

Pig iron prices are firmly maintained, but transactions are confined to small lots, for early shipment. The market stands at $42.50 for Bessemer, $43 for basic and $43 to $45 for foundry, valley basis, freight to Pittsburgh being $1.40.

POINTS IN WEEK'S MARKETING NOTES

Transportation problems are serious for many Canadian manufacturers now. There are cars of material on the way, and that is about all that is known of them.

—

One Toronto warehouse has had cars of tubes on the way from Pittsburgh since the end of March, with no word of their whereabouts.

—

It is stated that all that one firm of machine tool makers were able to ship in the month of April was $20,000 worth.

—

Dealers report a smaller inquiry for steel than a month ago, but state, on the other hand, that their sales remain very satisfactory.

—

The scrap metal market, owing to the embargo, is very quiet. Business must be either for use at home or storing for future shipment or speculative prices.

—

Pittsburgh intimates this week that the market may soon turn in favor of the buyers.

—

The production of pig iron in April, due to the strike, was about 75 per cent. of the capacity of the U. S. furnaces.

—

Germans have had representatives in England trying to find out what chance there is for getting the German machine tool on that market again.

—

A large number of makers of machinery and engines in Canada have a quantity of production partly finished, but cannot complete it because some of the parts are lacking.

BRANTFORD FIRM JOINS ONE IN ERIE

A Large Factory is Under Consideration —John R. Hall Co. is the Canadian Concern

The John Hall & Sons, Ltd., pipe machinery manufacturers of Brantford, have merged with the Williams Tool Corporation, of Erie, the largest manufacturers of pipe machinery in the United States, with a capital of one million dollars. John R. Hall & Sons, Ltd., are the largest manufacturers of pipe machines in Canada.

The Brantford plant will be known as the Hall plant of the Williams Tool Corporation. At present it is running to full capacity, and have been operating a night shift for some months past. No radical change will be made in the management.

Leslie S. Hall, president and general manager, will be vice-president of the American company, taking an executive position between the two plants. A. R. Hall will be manager of the local plant, and E. L. Williams in charge of the office. E. W. Hall is retiring as secretary and treasurer of the company, and E. L. Hall will no doubt continue with the new corporation on his return from England.

A larger factory is under consideration, but it is too early to give definite plans. The Brantford company set a number of records for speedy manufacture of war munitions machinery.

DAVIS-BOURNOVILLE MOVE TO TORONTO

Factory and Office Will Be United in New Building at 32-34 Eastern Avenue

The Davis-Bournonville Co. announce the removal of their plant from Niagara Falls, Ont., to Toronto. After the first of June the plant and offices will be situated at 32-34 Eastern Avenue, Toronto. The office, which has been maintained at 168 King Street West, will be transferred to the above address. The new building is 50 x 110 feet of brick and steel, and is about completed now. In it will be installed a model generator installation, which will distribute by pipes through the factory. The oxygen will be manifolded and piped through the premises as well. They will manufacture oxy-acetylene welding and cutting apparatus, and make automatic equipment, oxygraphs for die cutting, barrel welding machines and other automatic equipment. Mr. J. F. Crowley, who has been the district sales manager, speaking to CANADIAN MACHINERY of the changed location, stated that they were certain that with office and factory under one roof they would be able to get much better results in the way of service and output. The change of location becomes effective on the first of June.

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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Vol. XIII., No. 21 May 20, 1920

Discussion on American and British Pipe Threads*

Being an Extract From the Finding of the Committee of Manufacturers of Pipes, Valves and Fittings, Following a Conference Held in Paris, in Reference to the Adoption of an International Standard

By J. H. RODGERS

AT no other time in the world's history has there been a greater necessity or a more genuine desire on the part of manufacturers and engineers of the Allied countries for a better understanding of their mutual problems. A frank and liberal exchange of ideas will bring about closer international co-operation and secure greater uniformity in matters of standard practice. With this in view the following data has been compiled from the findings of the committee of Manufacturers, on Standardization of Fittings and Valves, with the hope of contributing to the common knowledge and shedding additional light on certain phases of the subject which may have been somewhat obscure in the past.

While it is generally known that the usual practice has been the adoption of the American or the British standards of pipe threads, it will be interesting to many to learn that in 1914, at a conference held in Paris, an International Pipe Thread Standard was proposed, but that so far, it has not been applied commercially. To familiarize the readers with the outline of the various standards, the following brief summary has been given.

The American Standard:

Pipe sizes—⅛ inch to 30 inches, inclusive.

Profile of thread—60 degrees V thread, slightly truncated.

Taper male and female threads are established.

Taper of cone (1 in 16).

Straight threads are recognized only for certain special applications.

Threaded plug and ring gauges are established.

Tolerances are established.

Dimensions are expressed in inches and millimeters.

The British Standard:

Pipe sizes—⅛ inch to 18 inches.

Profile of thread—55 degrees thread, rounded Whitworth.

Taper and straight male and female threads are established.

Taper of cone (1 in 16).

Straight threads are recognized for general use.

Threaded plug and unthreaded ring gauges are established.

Tolerances are established.

Dimensions are expressed in inches.

The Proposed International Standard:

Pipe sizes—⅛ inch to 20 inches, inclusive (3 to 500 mm.).

Profile of thread—55 degrees, rounded (Whitworth).

Taper and straight male threads are established—Two tapers are recognized (1 in 16) and (1 in 32).

Straight male threads are recognized for general use.

Gauges are not established.

Tolerances are established.

Dimensions are expressed in millimeters.

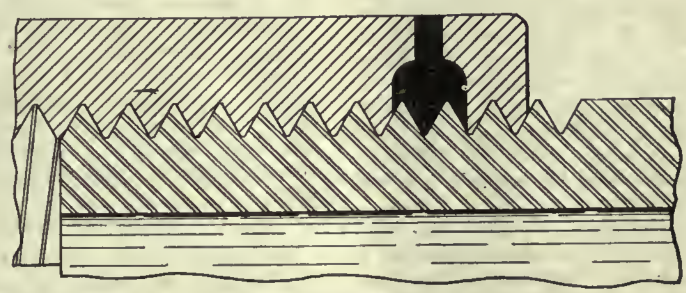

FIG. 17—STRAIGHT THREADS WITH LOCKNUT.

General Remarks on Pipe Practice

In America and Canada the general use of the straight male and female threads for pipe joints was discarded many years ago. This was forced upon the manufacturers by the urgent demand for interchangeability, and this condition is much easier attainable with product with a taper thread. By interchangeability is meant that ready method of making joints with pipe cut by one manufacturer, with valves and fittings made by another manufacturer, and with threads cut by the steamfitter, with dies made by still another manufacturer. The taper male and female threads for pipe joints is more firmly established on this continent than elsewhere. Some of the methods used throughout the world may be stated as follows:

Taper male and female threads.

Taper male and straight female threads.

Greater taper on female than on male.

Straight threads on male and female

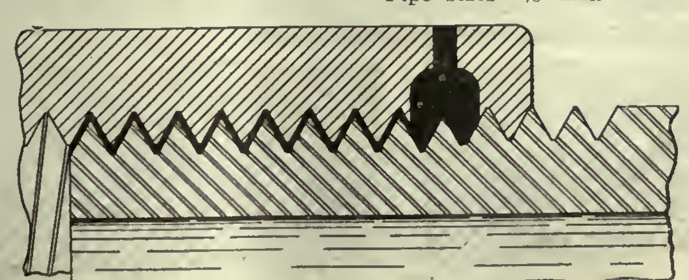

FIG. 18—STRAIGHT THREADS WITH PACKING AND LOCKNUT.

*Second of two articles bearing on pipe thread standards, the first appeared in the Feb. 19th issue.

joints with packing and locknut—Fig. 17.

Straight threads, with packing between male and female threads as well as under locknut—Fig. 18.

Various Standards in Use

Fig. 17 illustrates a joint made with a straight male and female thread, which requires packing to make a tight joint, and a locknut to retain the packing in position. No permanent metal to metal joint is made. This type of connection is used extensively in Europe. It will readily be seen that the efficiency of this joint is dependent very largely, on the packing and the locknut. Owing to the long thread engagement and the possible imperfections in the pitch, the possibility of making interchangeable product is greatly increased. Should the male thread be cut slightly undersize it is also necessary to use packing between the thread, as shown in Fig. 18. Where joints are subjected to considerable vibration and heat, the effectiveness of the connection is soon destroyed. This joint is still used to a small extent in the United States, but usually where the temperature and the pressure are comparatively low.

With straight female and taper male threads, or where the taper of the female is greater than on the male, the chief objection is that the actual effective contact only comes on a small portion of the thread length. Considerable use of this style of joint is the practice in Europe, but on this continent it is practically limited to wrought iron or wrought steel fittings, where the female section with a straight thread will yield sufficiently to adjust itself to the taper male when the oint is properly screwed together.

The ideal joint is where the two threads are given the same taper, as it gives a metal to metal contact throughout the entire length of thread, assists in filling all irregularities, allows reasonable variations in the diameters without destroying the interchangeability, and holds up under excessive pressure. In comparing a taper thread joint with a straight one, the efficiency of a drill socket might be cited, where the taper

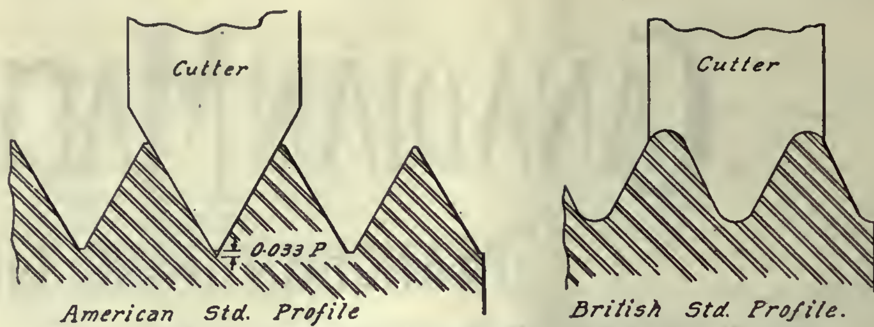

FIG. 21—PROFILE OF AMERICAN AND BRITISH THREADS WITH CUTTERS.

shanks of twist drills will adapt themselves to any make of drill press, while the same result would be virtually impossible with straight shank drills. In former days a steamfitter felt that he was shouldering a very heavy responsibility when called upon to put up piping to withstand a steam pressure of from 200 to 300 lbs., but with the Briggs standard as adopted in the United States and Canada, the highest pressure offer no greater difficulty than the ordinary low pressure installations.

In considering the merits of any pipe thread standard, it must be borne in mind that the ease of screwing pipe into fittings to make tight joints is the prime consideration. Users must be able to buy pipe, fittings or valves, indiscriminately and make whatever connections are considered satisfactory; therefore, any standard to be efficient must fulfill these requirements. The American standard is the only existing standard that has consistently met these demands for a long period of years. Its success has been due to a combination to desirable features, which are outlines herewith.

Profile of Threads

As shown in the previous article on this subject, the profile of the American standard thread was illustrated in Fig. 1. The flat or truncated portion of the thread is only slight, even on the coarsest pitch of eight threads per inch, where the flat measures about .004 in. The purpose of the truncation is merely to break the crest and the root of the sharp V, and thus facilitate the fitting of the threads. In commercial work, the pipe is generally threaded with dies which may be more or less worn, so that a perfectly theoretically cut thread is almost impossible. The first evidence of wear on a tap is the dulling or wearing down of the tops of the teeth, with the result that the female threads cut with a worn tap will have a rounded root, but the crest will remain nearly the correct profile, for the reason that the wear is greatest at the crest where the greatest work is done, than on the sides or the root. The same condition practically applies to dies for cutting the male threads. At A Fig. 19 is shown male and female threads that have been cut with dull tools. When the wear is not excessive, an almost perfect fit can be obtained with this type of thread, owing to the sharp crest forcing its way into the root of the thread and providing a metal to metal contact throughout the entire length of the thread engagement. The American thread affords greater opportunities for compensation for inaccuracies. Slight errors in the pitch of thread is easily taken up by this thread.

Where only one of the threads is cut with a dull or worn tool, the breaking down of the crest is only necessary on the opposite thread. Illustrations of this condition are shown at C and B in Fig. 19.

The profile of the British Standard pipe thread, as well as the proposed International thread, is shown at D Fig. 20, and has an inclined angle of 55 degrees, rounded at crest and root, and the taper is at right angle to the surface of

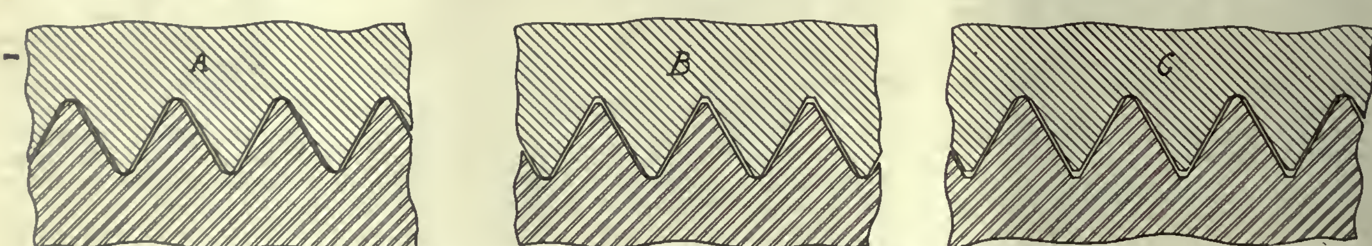

FIG. 19—UNITED STATES THREADS CUT WITH WORN TOOLS.

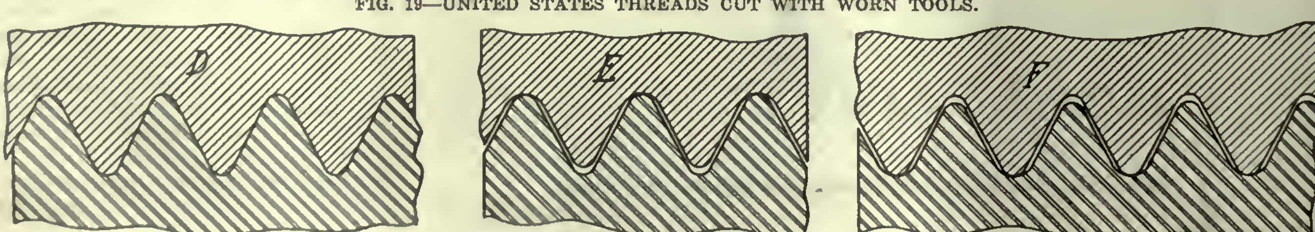

FIG. 20—BRITISH THREADS CUT WITH PERFECT AND WORN TOOLS.

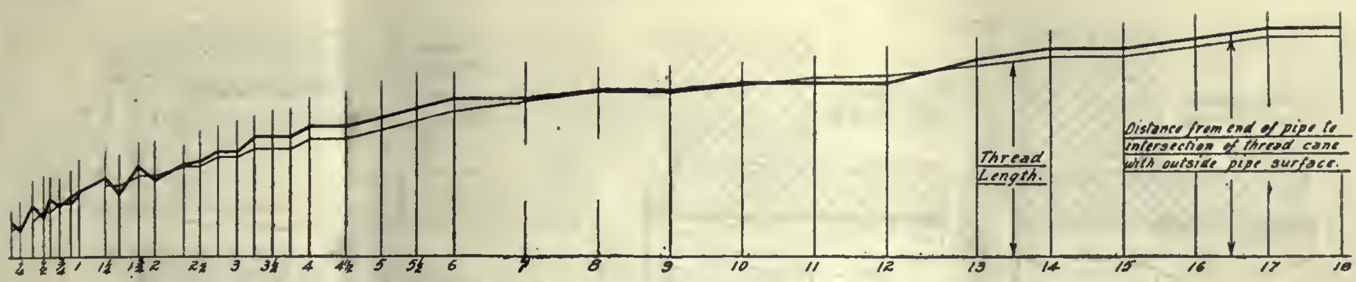

FIG. 22—COMPARISON OF BRITISH AND AMERICAN THREADS.

the cone. It might be well to state here that with perfectly cut threads, one contour of thread has no distinctive advantage over another, and any one will make a joint equally effective, but as perfectly machined pipe threads are impossible in commercial manufacture, the suitability of the various profiles to working conditions is the prime consideration. Owing to the inevitable wear of the cutting tools, it is obvious that the rounded crests of the British threads will not conform so readily to inaccuracies in the roots as the sharper crests of the American standard profile, so that the commercial made joints in all probability is only made on the rounded crests and roots. It is doubtful if the flanks will come into intimate contact. When realizing that the prime object of a pipe thread is to make a pressure tight joint under commercial conditions, the advantages of the American standard over that of the British is clearly evident. The result of worn tools when working on the British threads is illustrated in E and F in Fig. 20.

The rounded crests and roots in the British threads introduce complications in the manufacture of the different tools and gauges that make the interchangeable factor a serious problem. This is amply illustrated in Fig. 21, which shows the respective cutters for both the American and the British practice. The one tool will answer for a wide range of threads on the American thread, but in the British system the cutting tools and the gauges are limited to the one particular pitch for which it is used. When the latter has to be reground to operation requires very accurate attention, while the straight sides of the American thread offers little difficulty.

While the American thread is cut at right angles to the axis of the thread and the British thread is cut at right angle to the surface of the cone, there is little advantage that can be given to one over the other, but the manufacture of the taps and the dies are easier to make when the threads are cut at right angles to the axis of the thread.

Length of Threads

Fig. 22 shows the respective proportions of a 2 inch British and a 2 inch American thread, giving the relative lengths of perfect and imperfect threads, and also the effective thread length in each case. On every pipe size the American standard length of thread includes the two imperfect threads as indicated. The effective length of the American standard thread is expressed by the formula $(0.8G + 6.8)P$, where G equals the outside diameter of the pipe and P equals the pitch. The British standard length of thread is expressed by the formula (D ⅛ inch), where D equals the nominal bore of the pipe. The length of engagement in both cases is determined by the distance of the gauging point from the end of the pipe.

In comparing the advantages of one thread length over another, and deciding on the most suitable length, it is necessary to take into consideration not only the theoretical lengths mentioned above, but also the variations from these lengths permitted by the established tolerances. The thread must be long enough to give sufficient engagement under the extremes permitted by the tolerances. Too long a thread is objectionable as the additional imperfections must later be crushed in making a tight joint. In the American standard the tolerance is limited to one thread plus or minus from the gauge size, but in the British standard the tolerance established is expressed in terms of distance which bear no constant relation to the pitch of the thread.

In considering the effective length of the threads it will be noted that the American standard is based on the outside diameter of the pipe and the pitch of the thread, while the British is based on the nominal bore of the pipe only. As the outside of the pipe is the determining factor of a pipe thread it would seem to be more suitable basis from which to compute the thread length. However, the formula is of secondary importance, providing the length is suitable for practical application. By referring to Table 1, it will be noted that the number of effective threads on American standard pipe increases uniformly, being 7.1 on the ⅛ inch size and 30.8 on the 30 inch size. On the British thread the increase is irregular, a smaller size frequently having a greater number than a larger size. The same is true of the proposed International standard. This in itself is of no great importance, but it shows that the American practice is more consistent.

In order to make the diameter of the thread as large as possible with relation to the outside diameter of the pipe, thereby maintaining the maximum thickness of the pipe, the American standard utilizes the two threads with imperfect crests as effective threads. By referring to Fig. 22-A, it will be noted that the cone formed by the tops of the threads intersect the outside surface of the pipe between the end of the pipe and the end of the effective thread. The distance of this intersection from the end of the effective thread is a constant amount on all sizes, being equal to two threads.

By referring to Fig. 23, it will be noted

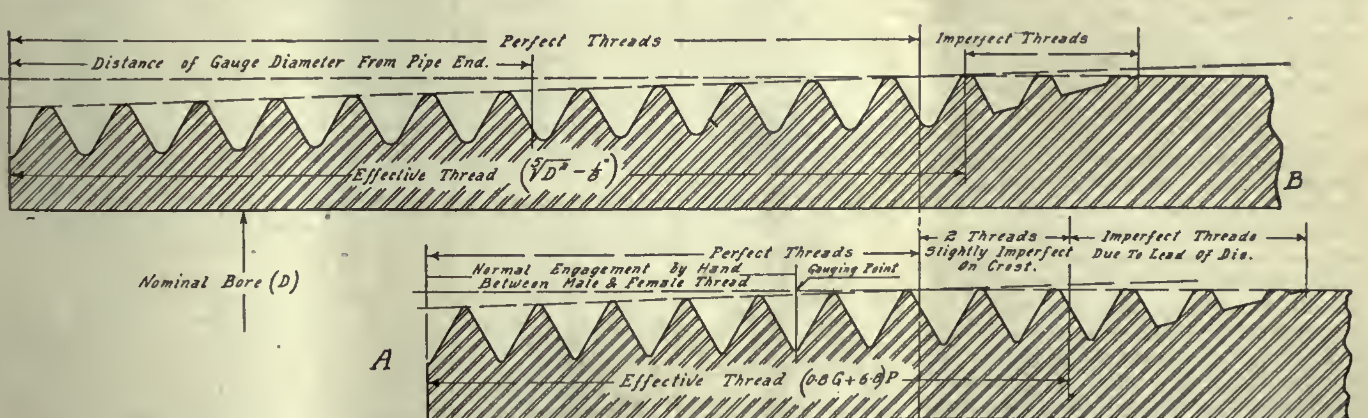

FIG. 23—BRITISH THREAD CHART.

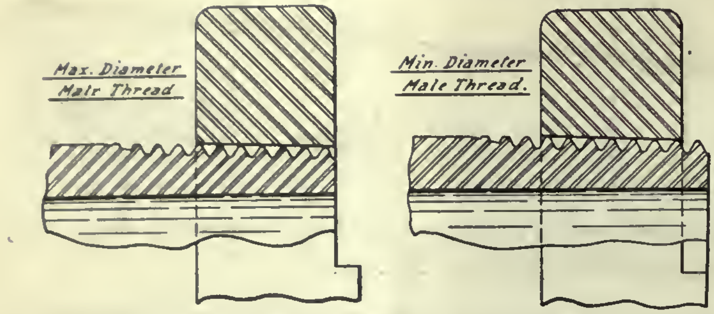

FIG. 24—BRITISH STANDARD RING GAUGE.

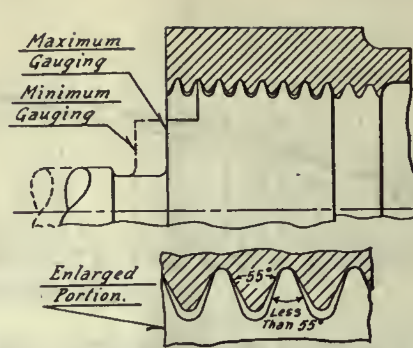

FIG. 25—BRITISH STANDARD PLUG GAUGE.

that there is no constant relation in the British standard between the length of the effective thread and the intersection of the thread cone with the outside diameter of the pipe. On sizes ¼, ½, ¾, 1½, 2, 11, and 12, the intersection comes between the end of the pipe and the end of the effective thread, and a portion of the thread is, therefore, slightly imperfect on the crests, but the number of such threads bears no constant relation to the pitch. On the remaining sizes, the intersection comes beyond the end of the effective thread, and there are no threads with flat crests. This again indicates that the American standard is more carefully studied out, and leads to the consideration of an important matter, a comparison of the practical advantage of one thread length over another.

It can be seen from Fig. 22 and also from Table 1 that the American thread is shorter on all sizes than either the British or the proposed International threads. On some sizes the difference is slight but quite pronounced on the majority of sizes. From this it is obvious that the longer the thread the greater amount of metal that will have to be removed from the outside of the pipe when cutting taper threads. Another advantage of the shorter thread is the saving in time required to cut the thread, and as the increased length is detrimental rather than beneficial the increased time required to cut the longer thread is an item of considerable importance.

Gauging

The method of gauging on the British standard is shown in Figs. 24 and 25, the plug gauge for the female thread being cut at a lesser angle than the work so that the crest of the gauge threads bear on the root of the threads in the fitting. The ring gauge for gauging the pipe or outside threads is a taper bore that fits over the crests of the thread, the tolerance being indicated by the notched portion of the smaller end of the gauge.

Another serious objection to too long a thread engagement occurs in designing valves and fittings. Referring to Fig. 26 it will be evident that the valves or fitting must be long enough to avoid interference at the inner end of the thread. In considering the pitch of threads, it should be remembered that successful application in service and in manufacture is of prime importance; furthermore, the number of different pitches for the entire range of pipe sizes should be the smallest number consistent with the ratio of pitch to diameter.

For maximum efficiency in any system of interchangeability it is imperative that the gauging be done on those surfaces that will be least affected by the wear of the cutting tools. Practice has demonstrated that the sides of the threads remain practically unchanged when male and female threads are forced together. Therefore, it is essential to gauge at this point only. No gauging should be done at crest or root, as these may alter when making the joints. The working plug gauge should enter the fitting by hand the same distance as the pipe itself enters, and the working ring gauge should screw on the pipe the same distance as the fitting screws on by hand. The distance the pipe enters the fitting is the most vital feature, as the remaining thread adjusts itself when properly screwed up. In other words, the gauges should be a replica of that

TABLE 1

SIZE	NUMBER OF EFFECTIVE THREADS ON PIPE		
	American	British	International
	TURNS		
⅛	7.10	10.50	11.00
3/16	...	...	7.45
¼	7.25	8.30	8.15
⅜	7.35	9.50	9.20
½	7.45	8.75	8.00
⅝	...	8.75	8.80
¾	7.65	10.50	9.65
⅞	...	10.50	10.50
1	7.85	9.65	9.55
1⅛	...	...	9.55
1¼	8.15	11.00	10.20
1½	8.35	11.00	10.40
1¾	...	12.40	11.90
2	8.70	12.40	12.55
2¼	...	13.75	13.20
2⅜	...	...	13.40
2 7/16	...	...	13.65
2½	9.10	13.75	13.85
2¾	...	15.10	14.50
3	9.60	15.10	15.15
3¼	...	16.50	15.80
3½	10.00	16.50	16.45
3¾	...	16.50	17.10
4	10.40	17.90	17.75
4½	10.80	17.90	18.60
5	11.25	19.25	19.50
5½	...	20.60	20.35
6	12.10	22.00	21.20
7	12.90	21.25	17.00
8	13.70	22.50	17.95
9	14.50	22.50	18.90
10	15.40	23.75	19.50
11	16.20	20.00	20.15
12	17.00	20.00	20.80
13	...	21.00	21.40
14	18.00	22.00	22.05
15	18.80	22.00	22.70
16	19.60	23.00	23.30
17	20.40	24.00	23.95
18	21.20	24.00	24.55
20	22.80	...	25.80
22	24.40	...	...
24	26.00	...	...
26	27.60	...	...
28	29.20	...	...
30	30.80	...	...

FIG. 27—COMPARTIVE LENGTHS OF EFFECTIVE THREADS.

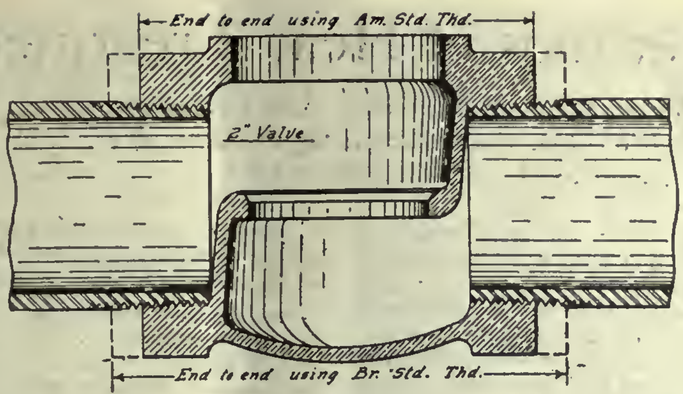

FIG. 26—COMPARATIVE THREAD LENGTHS OF FITTINGS.

portion of the joint which is made up by hand.

Summary

The ultimate test of any standard is its successful application in commercial manufacture and use for a long period of years. The American standard has met this test in every respect. Its success cannot be attributed to any particular feature, but is due rather to the aggregate of its desirable features. The profile of the thread, pitch, length of thread, system of gauging, each contributes a share, and these, combined with the fact that the standard as a whole is readily adaptable to commercial application, has made it highly successful in every sense of the word. From the standpoint of manufacture, it lends itself most admirably to large quantity production, and an interchangeable product is more easily produced than with any other pipe standard in existence.

INTERESTING WELDING JOB

The "Acetylene Journal" tells an interesting story of the welding together of two pieces of metal presenting a broken surface of 330 square inches. This occurred at the Trenton, N.J., shops of the Pennsylvania Railroad.

Through the lack of care of a yard employee engaged in cutting up old metal, a piece of 1¼ in. by 4 in. steel was fed into a shearing machine in such a way that a bolt in the metal broke off the shear blade at the heel of the knife. This was caused by the twisting strain presented when the bolt was caught between the shear blades. The broken face was 33 in. in height, 13 in. in thickness at the bottom and 7 in. at the top. An examination of the broken parts showed the metal to be of the highest quality of cast iron, there being no flaws or sand holes, showing that the break was due entirely to misuse. The shear has capacity for cutting 3½ in. round bars, 3¼ in. flat bars, or 10 in. by 1½ in. flat bars, and is as large as cutting machines of this type are usually made.

Immediate repair became a very urgent problem as it was impossible to order and secure a new machine under several weeks, if not months, and delay in replacement meant much delay in the making of billets and forgings for engine work, inasmuch as this shear is used almost daily in cutting metal for the large furnace from which billets are secured.

A great deal of work has been done with oxy-acetylene equipment at Trenton, but nothing to compare in size with the case here presented. The question of welding together broken pieces of so large a surface was submitted to an expert, who expressed the opinion that the two parts could be welded perfectly.

"Conscientious objectors" and scoffers were all there with their arguments against trying it, not realizing that even if a failure resulted we would be no worse off than with a broken shear, except for the expense entailed in the attempt. The matter of repairing was finally decided, and permission was given to do the work.

The broken parts were taken to the machine shop and the metal was planed away at an angle of 45 deg. from both sides of each piece, on one side to 65 per cent. of the thickness and to 35 per cent. on the other, so that when the two parts were brought together, lying on their sides, an edge only about ¼ in. thick remained. This was left as an aid in setting the parts for preheating and welding, and for the purpose of preserving the exact length of the shear blade. This work required two days, after which time the parts were ready for preheating.

The broken parts were laid flat, set accurately, and firmly secured. A firebrick furnace was built around them and a charcoal fire started. After eight hours of preheating the temperature was at the proper point to commence welding.

The deeper cutting, the 65 per cent. side, was welded first. Oxweld cast iron alloy rods of ¼ in. and ⅜ in. diameter were fused in from the bottom up and outward from the middle of the cutting. Ferro flux was used in this work, being constantly added to insure fusion of the metal.

After it had been filled and slightly reinforced to prevent fracture in handling the casting was turned over and the other side welded up in the same manner. It will be noted from the illustrations that the cavity to be filled was of an astonishing size.

Six welders were assigned to the work and were worked in relays of two each, using four Oxweld outfits with No. 15 welding heads. The extra number of men was necessary because of the intense heat generated, not only by the torches but by such a large mass of iron on a large charcoal fire. In fact, the heat was so great that those using the torches protected their faces with asbestos masks, and it was frequently necessary to dip their gloved hands into water to cool them. Compressed air also was used to blow the hot air away from the men at work.

The men engaged in the work were enthusiastic as to its success, and, knowing they were engaged in a most extraordinary undertaking, were exceedingly careful to see that nothing untoward should happen to endanger the success of their efforts, nor that any lack of attention should militate against the desired end.

There were used in the repair of this shear:

Oxweld cast iron alloy rod	445 lb.
Oxweld ferro flux	12 lb.
Acetylene	6,116 ft.
Oxygen	7,640 cu. ft.
Labor at 68c, in both pre-heating and welding	203 hours
Charcoal	100 bushels
Coke	20 bushels

The total cost of making the repair was about $400. The cost of a new shear blade is variously estimated at from $1,500 to $1,700, so that the saving by welding approximated $1,200, to say nothing of the loss by being deprived of the use of this machine.

The shear has been fully tested and is doing business as usual. It appears to be as good as new.

It is quite possible, quotes the "Scientific American," that cellulose nitrate lacquers will find application in peace times for certain specific purposes where quick-drying, hard, and elastic films are required. They may be admixed with pigments to produce colored coatings which dry to a flat, washable surface. When mixed with aluminum powder or zinc powder, quick drying hard primers for metal are formed. These primers may be used satisfactorily as the base for many metal finishes. As substitutes for shellac on some types of work they should also prove of value. These paints may be applied by spray, brush, or dipping, drying almost immediately to a moisture-resisting, flexible film. Baking at a low temperature is permissible. Cellulose nitrate lacquers act as excellent primers for certain types of cement floors that are to be painted. Through their use waterproofing greases or other materials in the cement are insulated from action on subsequently applied enamels. Cellulose lacquers or enamels are not as durable as those made with oil or varnish.

Captain Allan McIntyre of Parkhill, a veteran seaman who had sailed the Great Lakes for more than half a century, died in St. Joseph's Hospital at London, aged 87 years.

Talk on Modern Methods of Heat Treatment

No Doubt Practical, as Well as Technical Men, Are Following This Article With Interest—In This, the Concluding Portion, We Go Still Further Into the Heat Treatment Art

NEXT in order comes the selection of suitable boxes or pots in which pack the work for carburizing. Whenever the quantity of the work will allow for it the boxes should be designed especially for the work at hand. They should allow for no less than ⅝ in. of carburizer between each piece and walls of box, and two inches or more, depending upon the depth of box, between work and lid, for the convenient handling of them when packed and when hot, and for the efficient charging of furnace. Whenever it is practical I prefer the use of the circular chimney type of pot. With this type there is less chance of crowding the work in packing and in the charging of the furnace and the centre of pot being in the form of a chimney together with liberal feet under pot allows for the free circulation of the gases down, in and around, underneath and up through the pot, all of which go to make up a uniformly carburized product as well as cutting down the time and cost of the operation. There are articles of course that require a square or rectangular or a solid round pot. In Fig. 2 can be seen a few different types.

Next comes the question of suitable material for the packing boxes. Given in order of their superiority, according to an experience of about ten years, the various materials are: ordinary grey cast iron, white cast iron, cast steel and the alloy of nickel chromium called Ni-Chrome for short.

For nearly all purposes grey cast iron is the least satisfactory and in the long run is the most expensive. The special mixtures in white cast iron and cast steel are much superior to grey cast iron and are on about a par with each other with reference to their cost per service hour, but they scale badly and hold their shape only a comparatively short time. The value of nickel chrome for carburizing boxes is best illustrated in Fig. 3.

The two pots in the centre of Fig. 3 are of Ni-Chrome, the other four of .20-.30 Carbon Steel. The two pots in the centre were the very first of Ni-Chrome used by us and to prove the merits of this material it was decided to run a test by comparing one of them with four new cast steel pots under the same conditions. It was thought it might be a good thing to hold the one Ni-Chrome pot out so that we could compare a new pot with one that had been run. Accordingly one Ni-Chrome (this is at the left centre in Fig. 3) and the four cast steel (two at either end in Fig. 3) were run at the same temperature for the same time, never one without the other four, always in the same furnace, until the cast steel pots gave out. At that time the other Ni-Chrome pot was placed in service and we continued to use the one which had been run with the steel pots. We held the cast steel pots which failed in this run as a curiosity and up to the time the photograph was taken, the Ni-Chrome pot on the left had seen 1,300 hours service and the one on the right 650 hours. Fig. 4 gives another view of the pots in Fig. 3. While this is not the best which we have obtained with Ni-Chrome, it was the only example which I could actually show you and is presented for what it is worth. I might make reference to comparisons made on Ni-Chrome and cast steel jigs or crates as seen in Fig. 5. The cost per service hour compares favorably with that of cast steel and on account of the resistance to the action of furnace gases and the extraordinary physical properties which nickel chrome possesses when heated to moderately high temperatures the pots can be cast with much thinner sections than those of steel or cast iron, thereby affecting a saving in time and fuel.

Much has been said about furnaces, their design, the advantages of one type over another, their economy in point of fuel consumption, cost of maintenance, etc., but whether they be under fired, side-fired, or over-fired, whether they have one type of burner or another, whether they operate on gas or oil with low or high pressure air makes little difference unless they are constructed so as to provide plenty of room between the pots themselves and between the pots and the walls and the roof of furnace to allow for the circulation of the gases uniformly throughout and for proper ventilation of the spent gases.

Just as good results can be obtained by a good man on a poorly constructed furnace as can be obtained with an up-to-the-minute furnace operated by a man who does not know the right sort of a heat when he sees one. (This is just another way of pointing out the value of good men on the job.) The boxes must be placed in such a position in the furnace that they are exposed to the heat on all sides, top, and around bottom. They should not be placed too near the sides or vents of furnace, as this would cause one or both of two things; overheating at that one place or cutting off the circulation.

The position of the thermo-couple in carburizing is an all important one. If the time for carburizing is to be taken as "total time," that is, from the time the pots are placed in until they are taken out, then the thermo-couple should be located at that point where the pots would be apt to get the hottest if the furnace were fired somewhat hard. It should not be placed too near the pots as their mean temperature would influence the pyrometer reading to too great an extent.

We are no doubt all familiar with the practice of using test rods for determining the time at which the proper penetration has been obtained. These are usually any size up to ½ in. rod, depending upon the depth of case desired and bent over on the end to accommodate pulling them out with a poker. They

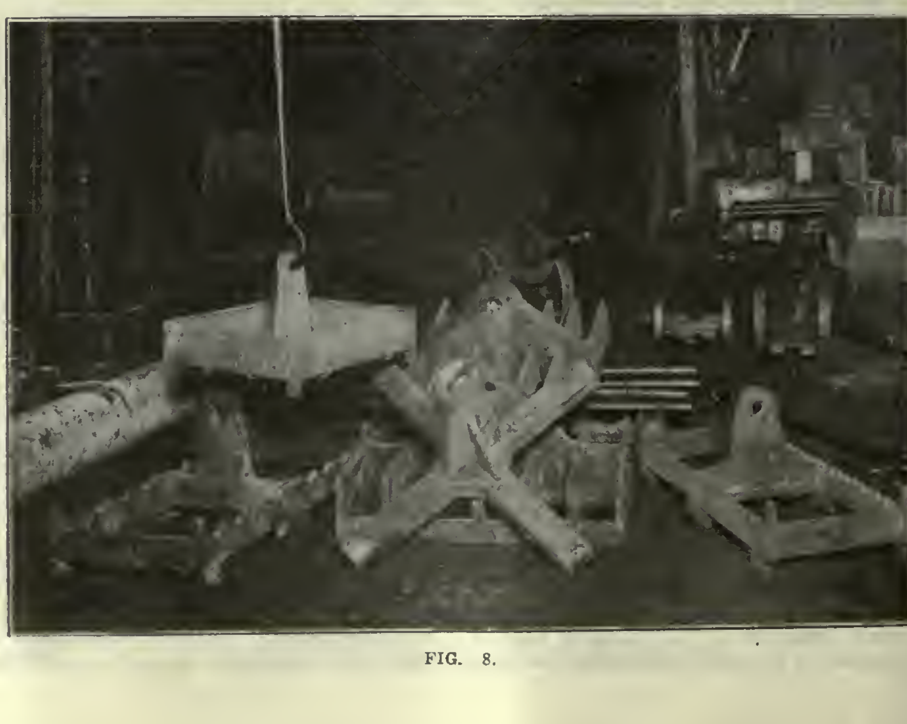

FIG. 8.

are packed down in the pot with the work, with the hooked end protruding up through the luting of pot and at intervals, after the pots have been in the furnace a sufficient length of time to heat through, they are pulled from the pot and quenched, then broken to determine the depth of case. This method is all right where the pots are covered with clay or cast iron borings, but does not work out so well where the covers for pots are of the same material as the pots unless drilling holes in the covers is resorted to.

A good method which has been followed for years is to pack the pyrometer thermo-couple down in the centre of one of the pots as shown in Fig. 6. This is accomplished by packing a piece of ordinary 1½ in. wrought iron pipe in the pot right along with the work. The pipe should be long enough to show about 4 in. above the pot when lid is on. A hole can be drilled in a few of the covers of each style pot to accommodate this and if not used on a pot with thermo-couple the hole can be plastered shut with clay. When the pots are placed in furnace the thermo-couple in its protection tube is put down through a hole in the roof of furnace into the 1½ in. pipe in one of the pots. Down, over and around the thermo-couple is placed a piece of 4 in. or 5 in. wrought iron pipe. This should be long enough to rest on cover of pot around the piece of 1½ in. pipe and show about 5 in. to 6 in. above furnace. The space around thermo-couple protection tube inside the larger pipe is then filled with cast iron borings and jarred down into the smaller pipe in pot. The temperature then indicated, after thermo-couple has been connected, is the actual temperature of the work. When this method is employed another thermo-couple should be used to indicate or record the furnace temperature. If the second couple is not used there is a chance of overheating the outer portion of the pots, especially if the furnace operator depends too much on the pyrometer and does not observe the temperature of the outside of the pots.

The carburizing temperature and time and whether the articles are to be left cool in pots or quenched directly from the pots depends entirely on the article, the steel it is made from and the depth of case desired.

The best practice in my estimation is not to exceed 1650 deg. F. on any carburizing work. With the higher temperatures when a fairly deep case is obtained it is practically impossible to dissolve the excess of carbon when it is desired to leave the articles cool in the boxes and the consequent brittleness often leads to more trouble and expense than that saved in the carburizing by the increased temperatures. For articles made from straight carbon or chrome vanadium steels have found that 1,600 to 1,650 deg. F. is a good working range and on chrome nickel steels 1,550 to 1,600 deg. F.

Some pieces made from simple straight carbon steel such as nuts, drilling jig bushings, pilots, balancing arbors, crank pins or the like can be quenched directly from the carburizing pots in running fresh water or brine. A type of dumping tank effectively used for the hardening of nuts and pieces where running fresh water is available is shown in Fig. 7.

FIG. 9

Other pieces such as punches for trimmer presses, drilling jigs, thin nuts, bushings, etc., which must be kept fairly true are best quenched entirely in oil directly from the carburizing pot.

For machine parts where the maximum of toughness and hardness must be combined a better method is to leave the pieces cool in the carburizing pot, reheat to a temperature as high as that used in carburizing, quench in oil and reheat again to a lower temperature high enough only to refine the case and quench in oil or water.

I have had no experience with the "gas carburizing" method and therefore do not feel qualified to discuss it other than to say that I have seen the process in operation and believe that there is a field for it which has up to this time been undeveloped.

The "liquid bath" method of carburizing is used mostly for those parts which require only a superficial hardness. The hardness is obtained by immersion in the liquid bath at temperatures usually between 1400 to 1500 deg. F. for anywhere from 5 minutes to an hour and quenching in either oil, water or brine.

Various Forms of Liquid Variety

There are various forms of processes of the "liquid" variety, some of which I presume the most of us have had experience with. The one most extensively used is without a doubt the "cyanide" process.

By this proces the liquid bath is made up of sodium chloride (salt), sodium carbonate (soda ash) and either yellow prussiate of potash, potassium cyanide or sodium cyanide is added to the melt to give the bath it's case hardening properties. Of the three forms of cyanide the sodium is the most used for this purpose.

The baths can be made up in different ways. One can purchase the salt and soda ash locally, of which the base is made up, and purchase the sodium cyanide of high cyanogen content separately, which is used to add the case-hardening properties; or the sodium cyanide can be obtained already mixed and fused with salt and soda ash in the proper proportions.

In addition to being used as a case-hardening bath the cyanide bath is used for reheating parts for hardening which have been carburized or made from tool steel which, on account of their character, would go out of shape if heated in a lead bath or muffle furnace. In this bath the parts are hung suspended either by their own weight on wires or in a basket. The opinion seems to be that when the work when cold, or considerably under the quenching temperature, is placed in the liquid bath, the salt immediately surrounding the articles solidifies and remains so until the temperature of the article has increased to beyond the freezing point of the solution, thereby retarding the rate of heating. The same thing, only the opposite phase, and more pronounced, occurs when quenching. The thin film of solution which adheres to the pieces heated in it retards the cooling effect of the quenching medium just long enough especially in those pieces with very thin sections, to prevent undue strains being set up in them.

It has the effect I know of preventing every possible chance of oxidizing the work in heating and when taking work from the heating to the quenching bath, as the work quenched from it is cleaner and more uniformly hard than that obtained by any other method.

Another and more recently-developed process called "The Shimer case-hardening process," is one which I wish to bring to your attention.

This process was invented by Porter W. Shimer in his laboratory at Easton, Pa., and was first developed commercially at our plant in co-operation with Mr. Shimer and under my supervision.

In this process calcium chloride and sodium chloride are used as a base, and when in a molten state calcium cyanamid is immersed in same to add the case-hardening properties. The calcium cyanamid in the form of lumps is immersed in the liquid melt of calcium chloride and salt in a basket or suitable perforated container. It does not melt, the case-hardening properties being extracted from the surface of the lumps, and usually about 5 per cent. of the total weight of the bath in calcium cyanamid suspended in the bath lasts about 24 hours, at the end of which time it is removed and replaced with new material. For our work we have found that the pieces of cyanamid can, with advantage, be used of the size of an egg or even as large as a man's first. We are informed by Mr. Shimer that he gets the maximum results in his work under other conditions by grading the cyanamid in quality and size of pieces, especially adapted and adjusted to different kinds of work and rates of production. For intensive use he used pieces much smaller than our present practice, the rate of action between the cyanamid and the bath being proportional to the surface of the cyanamid exposed. Just as the experienced man can tell when the case-hardening properties of a cyanide bath are becoming exhausted, so can the properties of the Shimer bath be determined. The properties of the bath can be judged by the activity of the bursting into flame of little gas bubbles which rise to the surface. The greater the number of these little flames and the more violent the bubbling of the bath from the evolution of these gas bubbles the stronger the bath. When the bath is being run at a temeprature between 1,400 and 1,500 deg. Fahr. and the action of these bubbles subsides, it is pretty good indication that the case-hardening properties are leaving the bath and it is then that the old calcium cyanamid should be removed and replaced with new. If the pieces taken from the bath are of fair size they can be broken again, thereby exposing new surfaces of the material, and can be used over again the same as new calcium cynamid.

The commercial applications of this process are practically the same as those of the cyanide bath with the exception that parts quenched in water or brine from it are somewhat more susceptible to rusting. This rusting, however, can be very easily counteracted by a thorough washing in a soda ash solution.

There are decided advantages in its favor and it does not, like the cyanide bath, give off poisonous and obnoxious gases; the men handling it need have no fear of becoming poisoned, and it is materially more economical.

We have used it exclusively since 1916 in the place of cyanide on all classes of work as a case-hardening bath as well as for heating purposes only, and I am certain, judging from our experience with it that the process has come to stay.

The process is covered by patents, and I understand that Mr. Shimer is about ready to launch it commercially. Anyone, therefore, who is interested in learning more about it, or who contemplates giving it a test, should communicate with him.

The heat treatment usually consists of one or two quenches in either, usually applied to bar stock or to forgings, and at times, when the parts are exceptionally large, after rough machining.

The heat treatment usually consists of one or two quenches in either oil or water from temperatures between 1,350 and 1,650 deg. Fahr., depending on the article and the physical properties desired, and a drawing back, or, as some prefer to call it, "an annealing," to somewhere under the critical temperature.

These steels with their subsequent heat treatment are used in parts where great elasticity combined with ductility are the requirements to resist shock and repeated stresses.

Following are given results of a few tensile tests showing the characteristic properties of steel in this class:

Type "AAA" chrome vanadium steel.

Carbon, .28/.33; mang., .65/.85; chrome .75/.90; van., .15/.20.

No. 1 stock as received from the mill.
Elastic limit 93,826.
Tensile strength, 126,735.
Per cent. of elongation, 21.09.
Per cent. of reduction, 61.22.

No. 2 same as No. 1, heated to 1,625 deg. Fahr. in muffle furnace, quenching in oil and reheated in muffle furnace to 1,075 deg. F., leaving cool in atmosphere.
Elastic limit, 127,750.
Tensile strength, 139,200.
Per cent. of elongation, 17.19.
Per cent. reduction, 61.00.

Chrome nickel steel—
.30/.40 carbon; .5 chrome; 3.5 nickel.
No. 3 stock as received from the mill.
Elastic limit, 62,330.
Tensile strength, 103,380.
Per cent. of elongation, 20.90.
Per cent. of reduction, 55.0.

No. 4, same as No. 3, heated thoroughly in muffle furnace to 1,450 deg. Fahr. and quenched in oil.
Elastic limit, 211,893.
Tensile strength, 232,342.
Per cent. of elongation, 4.88.
Per cent. of reduction, 24.25.

No. 5, same as No. 3, heated thoroughly in muffle furnace to 1,450 deg., Fahr., quenched in oil, reheated thoroughly in muffle furnace at 1,150 deg., Fahr., buried in mica until cold.
Elastic limit, 116,840.
Tensile strength, 127,950.
Per cent. of elongation, 14.84.
Per cent. of reduction, 57.6.

In those plants where the quantity of any class of work is great enough, this class can be best handled in automatic continuous heating furnaces and quenching apparatus, but where the work is of a variety with not enough of any one class of work to warrant an installation of the kind mentioned, it is a different problem.

A method of handling material such as the last mentioned consists of loading the work on jigs or trays as shown in Fig. 8, using furnaces built on a level with the floor and handling the loaded jigs to and from the furnaces and quenching tanks with a truck as shown in Fig. 9. The jigs are raised in and out of the quenching tanks with electric cranes on a trolley. Some judgment must be used, however, in the loading of jigs. If the work is piled too high without sufficient spaces between, uneven heating and cooling will be the result. By using a fork in place of a prong the truck shown in Fig. 9 can be used for handling large annealing and carburizing boxes.

We discussed some of the methods of heating for hardening in the fore part of the paper and they are again brought to our attention in the reheating for hardening of parts which have been carburized. Suffice it to say that the same things apply in this work as in the hardening of parts made from tool steel.

The Hump Method

A method of heat-treating which is steadily gaining favor with steel treaters handling parts which must be held to shape in hardening is the "Hump" electric furnace method.

By this method the articles to be treated are heated in an electric furnace

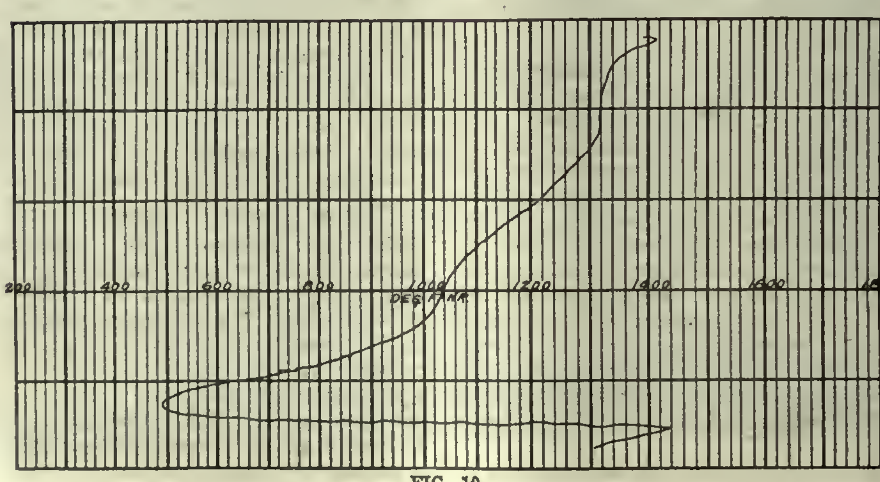

FIG. 10

in close proximity to the tip of a thermo-couple and quenched from a temperature governed by the "Hump" (or critical point), in the heating curve as shown on a recorder.

The furnaces are vertical, cylindrical in shape and of the wire-wound type. The thermo-couple protrudes up through the bottom of furnace and is connected by lead wires to a potentiometer recorder. A top made of special insulating material, which can easily be handled, seals the furnace when in operation so that it is practically free from an oxidizing atmosphere.

The principle involved might best be defined by quoting a certain man who said that: "What we are actually doing is making a transformation point of determination of every piece we harden.

All of us have no doubt taken a piece of steel, which we wanted to determine the critical point of, drilled a hole not quite all the way through it, inserted the tip of a thermo-couple in the hole, and after placing the piece in the furnace rising slowly in temperature watched for the point on our recorder or indicator where the temperature, which had been gradually rising, was momentarily arrested. That was the point we knew the steel had to be heated through to enable us to harden it. Exactly the same thing occurs when hardening by the "Hump" method, with the exception that all of the work cannot have holes drilled in it in which to place the thermo-couple. For different classes of work various ways of making thermo-couples can be resorted to without much trouble. For small parts where it is convenient to rest the work lightly upon or against the thermo-couple a hair-pin type with the wires bent and welded in the shape of a hair-pin works to the best advantage, while with fairly heavy work the ordinary twisted and welded couple is satisfactory.

The closer the work is placed to the tip of the thermo-couple and the more the thermo-couple is affected by the temperature of the work, the more nearly is the curve as shown on the recorder the true heating curve of the work being heated. In other words, we know that as any change in the E. M. F. generated by the thermo-couple would immediately be recorded by the potentiometer in terms of degrees of heat, and as any change in the temperature of the thermo-couple would change the E. M. F., generated by it, these changes in the temperature of the work being heated which had any influence over the temperature of the thermo-couple would be immediately recorded by the potentiometer. The extent to which the temperature of the thermo-couple is influenced by changes in the temperature of the work being heated is in proportion to the area of that part of the thermo-couple that is in contact with and affected by the work or that part which, being away from the work, is affected by the heat radiated from the walls of furnace. If the character of the work would permit it and it were possible to place it so that the tip of the thermo-couple was protected from contact with the heat radiated from the walls of the furnace (such for instance as placing a plug-gauge with a hole drilled through the centre of it down over the tip of the thermo-couple) the thermo-couple would be affected only by changes in the temperature of the work and the curve drawn by recorder would be the true heating curve of the work. A curve of this description is shown in Fig. 10.

We know that steel cannot be hardened under its critical point and that the higher above the critical point the temperature is from which it is quenched the greater the strains are which are set up in quenching. We also know that fast and uneven heating result in the warping and cracking of many articles. Then, too, I doubt whether there ever has been a hardener who has not had the experience of, at one time, successfully hardening delicate tools without warping or cracking them and then at another time in the attempt to harden the very same kind of tools have the corners "run off" or find that they had gone out of shape.

By the "Hump" method the particular temperatures, in so far as degrees of heat are concerned, at which the pieces are quenched, is of little consequence. "It is the point in or the number of degrees above the critical temperature," as shown by the break in the heating curve that indicates when the work should be quenched.

The operation consists of first heating the furnace to about the working temperature. The current is then thrown off the furnace by means of a switch, and the work is placed in the furnace, as mentioned previously, in close touch with the thermo-couple. The current is left off until the work and the furnace have "equalized," or in other words attained the same temperature; At this point the current is switched on and by means of the rheostat adjusted to suit the work. This may be 10 amperes or 15 amperes, depending upon the charge. By observing the temperature of the furnace walls and the work from time to time on new work the furnace can be regulated so that it is not too far in advance of the work. When the critical temperature is reached a deflection in the curve as drawn by recorder will occur, and from experience with other work one can judge how far above that point the work should be heated for quenching.

The furnace can be regulated to heat at practically any rate and with some judgment on the part of those operating it there is little chanace of heating unevenly.

By practice in determining the way they should be placed in the furnace, the speed with which they should be heated and the distance above the critical point they should be heated to, articles can be hardened with little or no distortion and with very little chance of their breaking.

We have hardened taps, reamers, cutters, punching dies, shear blades and gauges by this method entirely in salt brine with practically no distortion and without failure from hardening strains.

A Record is Worth While

Keeping a complete record of the parts hardened, such as the kind of steel, the shape and size of the articles, the shop number, the current used, the method of quenching, the hardness obtained, and the distortion which took place on the recorder sheet is of great help in the duplication of results and in planning the procedure to be followed in hardening future work of a different character.

The method is particularly adaptable

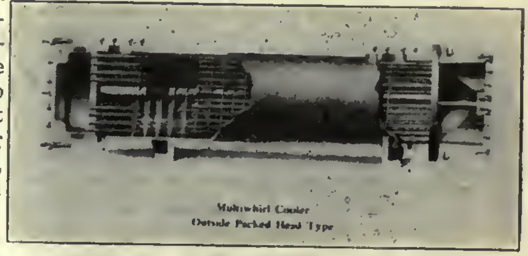

FIG. 12.

to productive work of a character where a minimum of distortion is allowed. As I have tried to point out, this method, through the manner in which the rate of heating can be controlled and the way in which the quenching temperature is determined, allows for the exact duplication of results.

If results were obtained to-day with a certain time temperature curve as shown on the recorder, anyone could rest assured that the same results could be obtained at any time in the future with the same heating curve providing the articles were the same, that they were made from the same steel and were placed in the furnace in the same manner.

For productice work it is best practice to have suitable jigs made to conveniently handle as many pieces as practical in the furnace at one time. Several jigs for each class of work facilitates the loading of some of the jigs while others are in the furnace and the quenching bath. Immediately one charge is removed from the furnace and quenched another should be placed in the furnace, so as to make it a continuous performance.

In addition to showing the heating curves of every charge the recorder sheet can be used as a production chart providing the number of pieces loaded on each jig are checked. In my opinion this is the only method of heat treatment where the work can be safely placed on a piecework basis without going to the expense of employing considerable additional supervision.

Adequate quenching facilities should be part of the equipment of every heat-treating plant.

To insure uniformity in quenching, whether the medium is oil or brine, there should be plenty of it and some means of circulating or agitating it and maintaining it at a constant temperature.

A method used in the past on oil consisted in running water through jackets surrounding each individual quenching tank and agitating the oil with compress-air. This method has it disadvantages. When air is used in oil that has become heated, it drives off the volatile matter in the oil and causes what is termed "fractional distillation." I have understood that when it is desired in some cases to thicken oil, compressed air is used for oxidizing or thickening it, and it can readily be appreciated why an oxidizing agent should not be used in quenching oil. In addition to the injurious effect compressed air has on oil, particularly at high temperatures, the condensation from the air lines might be great enough to cause the "boiling over" of the oil when it was rapidly heated up to above 212 deg. Fahr. Then, too, thinking of smaller work, the tendency must be considered toward non-uniform water is suspended, and the effect of cold air coming in contact with the work. By this practice the volume of oil in the tanks is kept at the proper level by the occasional addition of new oil to the old. This is poor practice as there comes a time when the new oil, being such a small proportion of the whole, is swallowed up by the old and has no effect at all on the viscosity of the bath as a whole. By this method also the water is not used to the best advantage.

Efficient Oil Quenching System

In my opinion the most efficient oil quenching system, in point of uniformity in quenching and economy of operation, and one being used by many of the larger heat-treating plants, is one of which the oil is pumped from an underground tank through a cooler to the quenching tanks and left run from there through an overflow back to the underground tank by gravity. The surplus carried in underground tank should be large enough to take care of the quenching until the whole lot of oil becomes too viscous for use, when it should be discarded and replaced with new oil. The underground tank should be of ample capacity (about the same quantity carried in underground tank as in all of the quenching tanks should be ample) and placed deep enough to allow for the draining of lines. The best type of intercooler known for this work is the "Multiwhirl" cooler as shown in Fig. 12. The cooler should be placed between the underground tank and pump. If the pump is placed between the tank and cooler and the oil becomes fairly hot a great deal of trouble is usually experienced with the pump bearing and packing.

A system of the character just mentioned serves as a means of maintaining the entire volume of oil in quenching tanks at a uniform temperature, agitating same in tanks (the cold oil would be forced in at bottom of tank and the hot oil would run off top through overflow) and taking care of the volume of oil in one tank until it was worthless.

While there has been much said and written about pyrometry, I thought it might be well, before closing the paper, to present a few of my views on the all-important subject.

Pyrometers are at best only tools in the hands of the heat treater.

They can be compared to the toolmaker's micrometers or gauges. The tool maker depends on his gauges only to guide him in the finishing of a tool. He does not rely on them to produce the finish that makes the tool saleable or fit for service, as they serve only to indicate the size of the article, and he uses his head and eyes in administering the finishing touches.

And the tool-maker's gauges are of little practical value unless they are rugged enough so that he need not be afraid to handle them, and they must be accurate to the point where he can rely on what they tell him.

Just the same is true in the case of the heat-treater's pyrometers. They serve only as a guide to him in informing him that at that point in the furnace where the thermo-couple tip is located the temperature is as indicated or recorded. It does not tell him that the entire charge in the furnace is heated thoroughly and uniformly at that temperature, but that only the tip of the thermo-couple is heated at that temperature. Nor does it tell him what the nature of the atmosphere in his furnace happens to be.

The same as in the case of the tool maker, the heat treater must use his head and his eyes to determine if the work in the furnace is heated uniformly at same temperature as the tip of the thermo-couple and to determine the nature of the atmosphere in the furnace.

But the guides should be worthy of being called such and should be thoroughly dependable in so far as it is possible to obtain them. The very best is none too good.

The instruments themselves should be sufficiently robust and constructed so as to stand up under shop conditions such as dusty, smoky and damp atmospheres; their accuracy should not be affected by vibrations such as are found at the average plant where there is moving machinery and heavy hammers or by atmospheric temperature changes; and since it is impossible to obtain any instrument which never needs any adjustments, they should be of a character which would allow for these adjustments on the job.

The thermo-couples should be of a character which would withstand ordinary shop handling, and whether they are made up on the job or purchased from the manufacturer of the system they should be interchangeable.

The method of controlling or compensating for the cold and temperature should be a practical one.

To be useful to the point where the heat treater can depend on the temperature indicated or recorded as being the exact temperature of the tip of the thermo-couple, the pyrometer system (or the guides as we have called them) must be accurate.

The accuracy and the constancy of any pyrometer system is governed largely by the systematic checking and calibrating of it, and of course by the manner in which this is accomplished. Too much importance cannot be attached to the selection of the individuals to perform this work.

A capable man can obtain greater accuracy with an inferior installation than an inexperienced man could obtain with the best, but the greatest accuracy is to be obtained with the best of both.

Time does not permit me to go into the calibration of pyrometers other than to say that it is the constancy, or the sameness, or the uniformness, with which the calibrations in the laboratory and checks in the shop are carried out that are most instrumental in helping to make up a uniformly heat-treated product

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In a paper read before the National Academy of Sciences, Major-General George Squier, Chief Signal Officer of the United States Army, stated that an invention now perfected would shortly do away with expensive undersea cables and enable messages, both telegraphic and vocal, to be transmitted with the aid of bare wires laid under the sea or buried in the earth. Messages would be transmitted by wireless and the naked wire used merely as a guide.

In some interesting experiments on belt driving discussed in the "Sibley Journal of Engineering," Mr. W. N. Sawdon mentions that the carrying capacity of the pulleys was low and that as soon as the slip exceeded about 2 per cent. it was impossible to keep the belt on the pulleys. It was found that the pulleys were comparatively rough and still bore the tool marks, although they had been smoothed down to some extent with emery or sandpaper. The pulleys were then dressed down with emery cloth and oil until all traces of the tool marks were removed. In this condition it was found that the slip for small loads was materially increased, but the belt could be kept on the pulleys without difficulty with slips as high as 10 per cent., and the carrying capacity of the pulleys was greatly increased.

INTERESTING FACTS TO BE FOUND IN THIS WEEK'S ADVERTISING SECTION

How to secure larger output.

How I can learn more about the Engineering business.

All about a stirring and stabilizing process.

How to make a good buy in books.

How to properly straighten wire.

All about a moving picture release.

How to put efficiency into a shop.

That it does not pay to be prejudiced.

How to handle any material.

How to correct inaccuracies in new or used tools.

Why a certain gentleman came to Toronto.

How you can combine a punch and shear.

Why it does not pay to have a machine standing idle.

Can You Widen Your Planer to Advantage?

Here is How One Firm Widened Their 24-inch Planer, Three Inches on Each Side, to Accommodate Larger Work—The Construction and Details of Lining Up Are Given

By DONALD A. HAMPSON

IT IS the experience of nearly all shops that their planer or planers are found to be too narrow. Though originally selected of a width ample for the work, the expansion of business and the unexpected jobs that appear almost always run wider than the distance between the uprights; rarely are these jobs too high or too long for the machine, and herein lies the outstanding feature of the open side planer.

Ours was a typical case. We were making a line of cast iron table tops and surface plates that were from 2 to 6 inches in thickness and of large and small sizes. The large sizes were from 36 to 40 inches in width, the small from 20 to 24 inches, and the length in both cases was roughly double the width. There were three planers in the shop, one a 24 inch, taking care of the small sizes very nicely, and one, a 41 inch doing the same for the large sizes, aside from the fact that it had a 14-foot table which consumed a good deal of power to move and there were conditions which prevented us from ordinarily running two plates on the machine at one time.

Changes in the trade we served created a demand for plates 26, 28, and 30 inches in width to the partial exclusion of the other sizes. It was not as convenient to run these on the large planer, the latter consumed too much power any way, and the price of a new 30 inch planer was out of proportion with the return from the work.

After a careful inspection it was decided to widen the 24 inch machine three inches on a side. The cross rail was long enough to feed 36 inches, so there was no difficulty there, merely a case of resetting the studs on the back for the clamps. The bed was of sufficient width for our work without any objectionable overhang. The first shaft (the pulley shaft) and the second one were long enough to permit resetting the pulleys and gears approximately half an inch at each end, which was all that was needed to clear the housings in their new position. These minor items being disposed of, it left but the moving of the housings and the top cross piece.

Fig. 1 shows the construction. Each upright was held to the bed by four 1 inch through bolts tightly fitted in reamed holes. Also the bottom edge of the castings rested on a machined ledge on the bed. Our method of widening was to make two spacing block castings to go on in place of the uprights, one of these being shown as B in Fig. 2. These blocks were planed to rest on the same ledge on the bed, then they had a downward extension carried outward to provide another ledge in the same horizontal plane on which the uprights were finally rested. New bolts were made up but left a shade large for the final fitting.

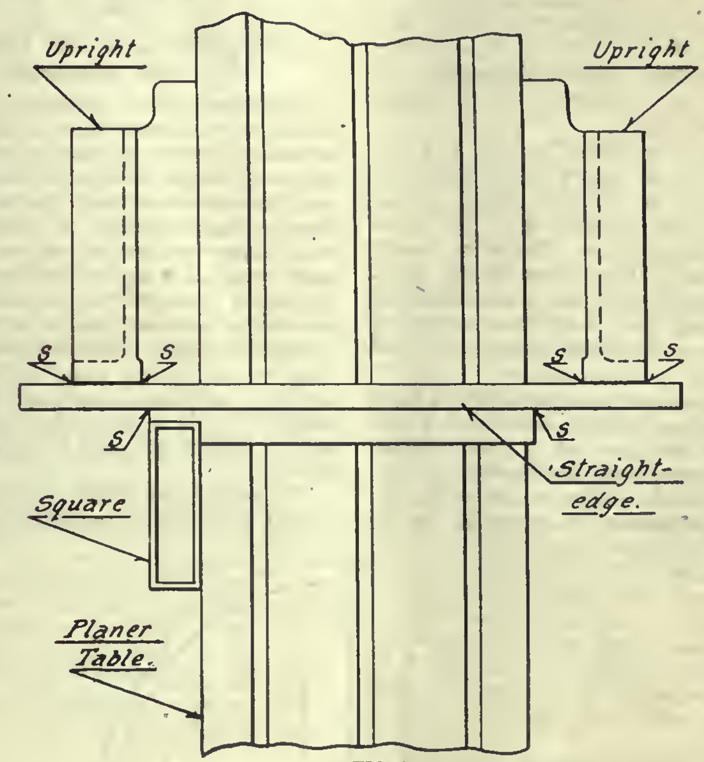
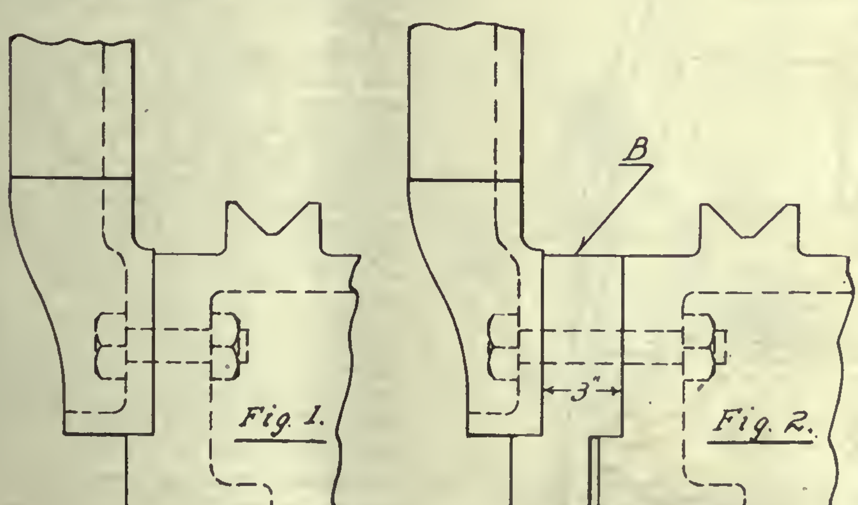


FIG. 3



FIGS. 1 AND 2.

Before the machine was taken down the bed was carefully levelled up and securely fastened in the levelled position. Then the top face of the table was gone over with a flat tool and the sides given a light, true cut. These precautions were taken to give us accurate faces from which to align our new work as well as to improve the condition of the table. Checking the faces of the housings, we found them square both ways with the table as trued up.

In assembling the upright housings, the two end holes were first reamed, while the castings were held tight by ⅞ in. bolts in the other holes. The accuracy of the setting as this reaming progressed was checked as shown in Figs. 3 and 4. We had some new tools including a 24 in. Starrett square and a 36 in. straight-edge; these were of great value in the work, for without good tools the accuracy could only be assumed.

Fig. 3 shows how the straight-edge is placed across the face of the uprights, where the truth of the front faces is readily ascertained by tissue paper slips "S" and "S." Then the square is placed with the butt against the trued side of the table and its blade tested against the lined-up straight-edge, using other slips of thin paper. When these slips are all tight there is no question as to the housings being square with the travel of the bed. The check on this and on the accuracy of the square, too, is to reverse the square, placing the butt against the other face of the table.

This lines the uprights at the bottom. At the top, the straight-edge alone is used. The square cannot be used here but if it has been used at the bottom and the straight-edge holds all four slips of paper at the top, the work is being done with all reasonable accuracy.

Checking the uprights the other way is shown at Fig. 4. Tissue paper feelers are again used. If any discrepancy is discovered, it is corrected before finishing the reaming.

With the end holes reamed and the bolts finished to fit, the centre ones may be directly reamed and fitted. This leaves but the assembling of the cross rail and the top piece. The former needs no comment. The latter being short three inches on each end, a spacing block was inserted, this being micrometered the same as the block against the bed below.

The elevating screws were left in their original place, which necessitated but one minor change—that of putting holes through the spacers and moving up the bevels to mesh. This design might be open to criticism, in that it leaves the screws within the space between the housings. However, it is possible to run work 8 inches in height under the lower ends of the screws. And if there does appear a higher job the rail is first elevated to the proper height, when the screws are backed out of their nuts, leaving the rail fastened, as always, by the clamps. Then, too, a high job is apt to be a narrow job and in a majority of cases will pass between the screws.

This widening costs less than $100 for labor and material, figuring the labor at $1 an hour, though the work was all done by the shop force, who were of course not paid that much. We secured a larger planer at a minimum of expense. It was wide enough to take in our new work and plenty powerful enough without being a big consumer of power, yet the change had not effected the ease with which a small planer is handled.

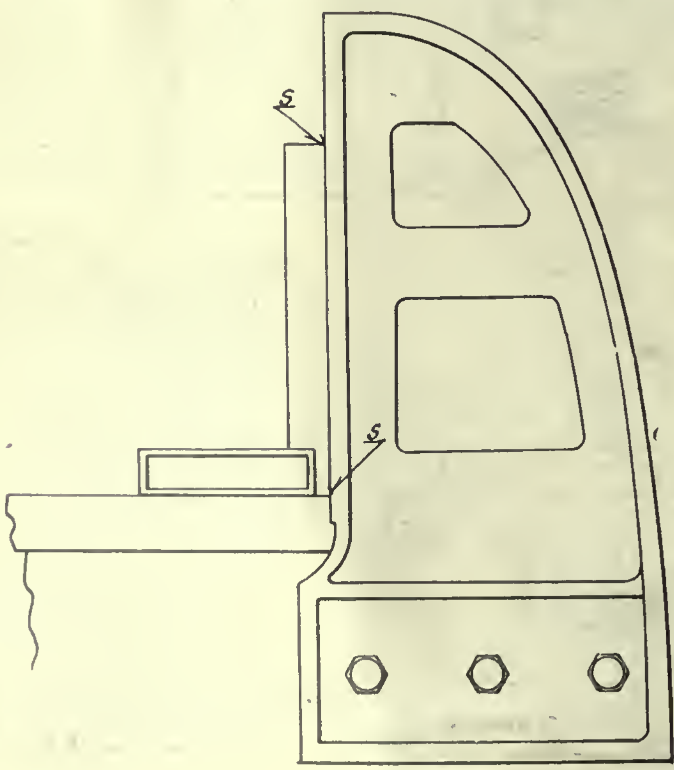


FIG. 4

RECUTTING WORN FILES

By W. S. Standiford

In these days of efficiency methods and high prices, everything is being done by the managers of machine shops, automotive plants and other factories to keep the operating costs as low as possible. The utilization of articles that were formerly regarded as wasted, once they were used up, is receiving the attention of various manufacturers who are saving large amounts of money yearly by reclaiming used lubricating oils, dirty waste thrown away by workmen, and other articles, the railroads being the leaders in this respect, they having the matter worked out with the greatest efficiency.

The writer has found out during his travels over the United States and Canada, that the average machine shop (which uses up large quantities of files in a year's time) foreman does not seem to know that worn files can be recut, and allows them to be thrown away in the scrap heap. In spite of the extensive use of machinery there is some work which has to be done with a file, there being no substitute for the latter in some lines of work for finishing articles. The file as a cutting tool is used so extensively that it will pay to re-cut them, which work can be done by the man who sweeps out the shop, it taking only a few minutes of his time, if too many are not allowed to accumulate at one time. Two dozen can be conveniently handled by the shopman without interfering with his other work.

The acid mixture is cheap and don't cost much, in fact, many mills and factories have a supply of acid on hand, it being used, mostly, to remove the scale from iron and steel—called pickling. In the formula given the proportions of sulphuric acid and water are so arranged as to do the re-cutting in from 10 to 12 hours' time. All that the shopman has to do is to clean the files and put them into the acid solution before leaving the shop at night, and in the morning they will be done. First clean the files with a "file card" and then put them into a solution composed of four ounces of washing soda and one quart of hot water—having the latter as hot as can be comfortably borne, and scrubbing them with a brush. This removes any oil on them. Then rinse them thoroughly so that no soda solution will remain, and transfer the files to the acid-cutting fluid, which is made up of four ounces of sulphuric acid and one quart of water, pouring the acid into the water slowly and stirring with a stick.

Do not reverse this proceeding or the acid will fly up in the face. Too great care cannot be taken when any person is handling acids. Mix the acid solution in an earthen or a glass vessel, making up enough of the fluid to cover the files. Let the latter remain 10 or 12 hours and the job is done. Rinse them in water thoroughly to remove all traces of the acid, dry and oil them well and put away in stock room until they are wanted for use.

In some localities the water is alkaline and more acid will have to be used to counteract it. Distilled water will obviate the necessity of using more acid in using alkaline water. A good way to test water for alkalinity is to dip a piece of red litmus paper (which can be bought at any drug store for a few cents) in the water, for five minutes. If it turns blue when first put in, the water is strongly alkaline, but if it takes five or more minutes to turn it blue the water is only slightly so. This test is one of the most sensitive ones that chemists possess, and will enable the workman to regulate the amount of acid needed for file re-cutting. Blue litmus paper turns red when dipped into acid, so a ready means exists for testing the strength of acid file-cutting solutions.

WELDING AND CUTTING

Lessons of the A.B.C. of Good Welding

This is the Fourth Lesson by an Authority on the Subject—The Remainder of the Series Will Follow

By W. B. PERDUE*

ONE of the principal reasons for the success of the graduates of efficient welding schools is that they are trained "trouble shooters" and know the "why" of their apparatus from the tip of the torch all the way back to the generator or gas cylinders.

The successful instructor keeps both mind and muscles of the student busy. This is not difficult, since there are so many new and interesting things to be

learned that even those students who have held positions as foremen in large welding shops are always eager for the next lecture.

While training his muscles to execute a neat "ripple" the student has ample time to master the intricacies of regulator and torch construction and thus become versed in "trouble shooting" and acquire the knowledge that will enable him to select equipment from the standpoint of merit and its adaptability to his own particular requirements.

Nothing is more important than the selection of good regulators, made for welding work. A recent canvass of 137 welding shops showed that only 28 were equipped with welding regulators, the others being equipped with small regulators intended by the manufacturers for lead and carbon-burning outfits.

Salesmen, unfamiliar with the requirements of the user, are often responsible for the delivery of equipment entirely unsuited to the purposes for which purchased. The prosperity and full development of the welding industry depends primarily upon the ability of the operator to select equipment that will meet his needs and to preserve same in efficient working order.

There is nothing occult or difficult about welding. Theory, practice, and common sense are the essential factors to which must be added the business initiative essential to success in any calling.

The purpose of the welding regulator is to furnish gas to the hose lines at reduced and unvarying pressures. The regulator is an instrument of precision that requires careful handling. Accorded proper treatment it will give long and efficient service.

Welding Regulators—How Distinguished

Regulators for lead and carbon burning, soda water outfits, etc., are not required to deliver gases in the volume required for welding. Therefore, to lessen expense of construction they are made with 2 or 2½ inch diaphragms. When used for welding, the rapid vibration of the diaphragm of the small regulator soon cuts out the composition seat (7), injures the nozzle (8) and in time buckles or cracks the diaphragm (14). The diameter of the diaphragm on all standard makes of welding regulators is 3 or more inches.

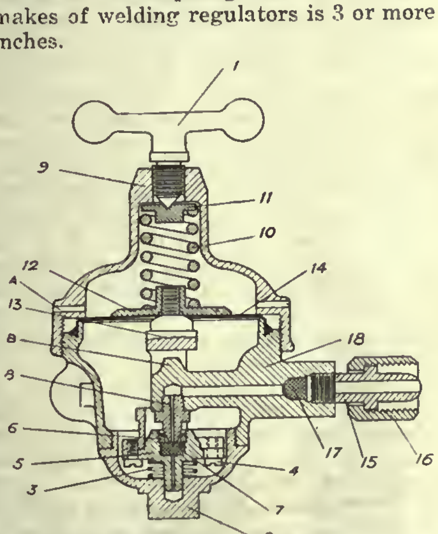


FIG. 15—VIEW SHOWING SECTION OF PERFECTYPE REGULATOR.

Nomenclature of Regulator Parts

1. Pressure adjusting key.
2. Back cap.
3. Compensating spring.
4. Centre piece screws.
5. Back centre piece.
6. Seat-retaining plug.
7. Seat.
8. Nozzle.
9. Front cap.
10. Pressure spring.
11. Spring button.
12. Diaphragm plate.
13. Front centre piece.
14. Diaphragm.
15. Cylinder connection.
16. Cylinder nut.
17. Wire cloth screen.
18. Regulator body.

Principle of Operation

The illustration shows the outline of the "Perfectype" welding regulator. With the exception of the safety vents A, and the safety button B, which prevents the buckling of the diaphragm by application of excess pressure on the pressure adjusting key, it is similar to any other regulator.

Gas enters the regulator from the cylinder through the cylinder connection 15 and the nozzle 8. Pressure applied by means of the pressure adjusting key 1 is communicated to the front centre piece 13 and to the back centre piece 5, in which the seat 7 is secured. Forcing the seat away from the nozzle permits the gas to fill the body of the regulator from when it passes through a connection not shown to the hose's connecting with the torch.

When there is sufficient pressure, the force of the gas pressing against the diaphragm 14 equalizes that of the pressure spring 10 and allows the compensating spring 3 to force the back centre piece and seat against the nozzle to prevent increase of pressure. Gas being drawn from the regulator the pressure spring overcomes the pressure of gas against the diaphragm and repeats the above process. With proper spring adjustment and large diaphragm surface, these opposing forces are so nicely balanced as to cause the regulator to operate without any noticeable change in pressure.

Regulators for heavy cutting are similar to those for welding, the principal difference being the use of stiffer springs to give greater pressure. Here, large diaphragm surface is even more important than in welding, since the flow of gas is much greater. For extremely heavy cutting a large "Jumbo" regula-

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ter, with at least a 4-inch diaphragm is absolutely essential to economy and efficiency. Better still, use several large regulators connecting the hoses leading therefrom to a "Y" from which the single hose leads which supplies the torch. Where oxygen is being used at the rate of from 100 to 250 feet per minute on heavy cutting work it is poor policy to attempt to economize by means of cheap equipment. Speed is the essential factor —any equipment which increases speed reduces the cost of the job.

Oxygen regulators for welding are adjusted by the manufacturer to deliver oxygen at pressures varying from a few ounces to 75 pounds pressure. They will answer all ordinary requirements for cutting work. Where heavy cutting is contemplated a regulator that will deliver higher pressures can be furnished.

Acetylene regulators are similar in construction to oxygen regulators, but are not set to deliver gas at high pressures. The gauges on acetylene regulators are of lower calibration than the pressure carried in oxygen cylinders, and would not withstand such high pressure.

Regulators Not Interchangeable

To prevent their being used interchangeably the cylinder connection stems are sweated in. The connections to the cylinders in which the different gases are supplied are furnished with different threadings. A careless operator cannot attach a regulator to a cylinder other than that for which it is intended.

Precautions Necessary When Attaching Regulators to Cylinders

Remove the pressure-regulating screw (1) and do not replace until the pressure from the cylinder has been turned on. Before attaching regulator the cylinder valve should be opened slightly to blow out any dust or dirt that may be present, and left slightly cracked to permit the pressure to enter the regulator gently when attached. As soon as the full cylinder pressure registers, the cylinder valve should be opened wide (jammed open) to prevent leakage.

What Happens if Pressure-Regulating Screw is Not Released Before Turning on Cylinder Pressure

The cylinder seat (7) will be held away from the nozzle (8) by the pressure on the spring (10). The inrushing gas from the cylinder will force the diaphragm violently outward. The impact of the seat against the nozzle may injure either or both. This causes the regulator to leak or "creep." The pressure within keeps rising, sometimes only a few pounds, more often until it menaces the working pressure gauge or diaphragm. For this reason needle valves should never be used as regulator outlets. A slight leak with a closed needle valve outlet may cause serious trouble. This is lessened by the elasticity of the hose lines. The resiliency of the pressure within the hose often causes a creeping regulator to "find itself" and become securely seated.

Remove the parts in numerical order to 7. If the nozzle is injured it must also be removed and replaced. If the seat is merely dented it may be turned over and replaced. If this has already been done and a new seat is not available, measure its thickness carefully, using a micrometer if possible, and then smooth the surface by means of a fine, clean file. Punch a shim from sheet brass of paper to give the original thickness of seat. Place this in back centre piece beneath the seat and screw retaining plug in firmly.

Replace all parts in reverse order, being careful that none are omitted, then attach regulator to cylinder and turn on pressure. No gas should escape from outlet until pressure is applied to pressure-adjusting key. If the regulator does not respond with pressure at the first half-turn of the pressure-adjusting key the shim inserted is too thick. Many a regulator, in otherwise good condition, has been ruined by carelessly placing thick shims beneath the seat.

If gauges have been removed from regulator to make this repair it will be necessary to use a little shellac as a filler on the threads by which they are attached to the body of the regulator. Use nothing else as a substitute. It might cause trouble.

Gauges Vary With Temperature

To a certain extent the pressure within the oxygen cylinder increases as the temperature rises, and decreases as the temperature falls. The difference indicated by the reading of the gauges at the time of commencing and finishing a repair is sufficiently accurate to be used as a basis for the computation of costs. This cannot be done with the acetylene gauge, which varies to a much greater extent as the temperature changes. A good flow meter gives a fairly accurate idea of the acetylene consumption, but even this is only an estimation. The contents of an acetylene cylinder can be accurately determined only by weight, there being exactly 14½ cubic feet of acetylene to the pound.

In estimating costs it is safe to assume that the quantities of acetylene and oxygen consumed are equal.

If clamps are not available or do not prevent leakage, it may be necessary to fasten connections to hose with wire. First attach the nut to the torch and give the tail-piece a light coating of shellac. Then push the tail-piece into the hose, but not hard enough to cause the hose fabric to bind against the nut. Take two turns of non-corrosive wire around the hose. Hold the ends taut and roll the hose back and forth. With the wire still taut twist the hose until one full turn is given the ends of the wire. Twist the ends together by means of pliers, bend the end slightly and hammer down out of the way.

The cylinders in which acetylene is supplied are painted black. To prevent danger from interchange of hose, that used for acetylene should be black and that used for oxygen red. Hose should be strong, light, flexible, and of the proper bore to give the necessary flow of gas without reduction of pressure.

Hose connections should be made by means of special nuts and stems supplied for that purpose. It often happens that the use of a tail-piece with a small bore causes a very decided loss of pressure between the regulator and the hose. It is for this reason that the author insists that welders should be taught to make the proper adjustment of torches without reference to pressure tables.

Welding Does Not Impair Vision

No other light can be compared to that of acetylene for lighting dwellings. The brilliancy of the welding cone, however, is such as to require goggles of special protective glass. No injury to the eyes will result from welding if the goggles selected are fitted with proper lenses of a shade that it not too dark. The lenses which protect the eyes from the glare and the ultra violet rays of the flame should have renewable front cover glasses which may be discarded when they become fouled with specks of oxide. These cover glasses should be of ground, not blown glass. Operators who ordinarily require glasses should have their prescriptions ground into the colored lenses of the safety goggles used for welding.

Connecting New Equipment to Acetylene Cylinder

Observe that no flame or fire is sufficiently near to ignite the acetylene. Blow dust from cylinder connection and wipe out with cloth or waste. Attach the regulator and open cylinder valve. Make sure (by sense of smell) that there is no leakage at any point and that no gas is escaping from outlet of regulator. To locate leaks use soap and water with a cloth or brush.

Connecting and Cleaning Acetylene Hose

Attach acetylene hose to and insert the pressure-regulating screw in the regulator. Turn screw to the right until pressure of five pounds shows on working pressure gauge. This will blow out the dust which is always present in a new hose. Release pressure by turning screw to the left until flow of gas is stopped.

Connecting Acetylene Hose to Torch

With the needle valves of the torch closed, connect the acetylene hose to connection on torch marked "acetylene," and having selected a tip of the size desired, turn on the pressure at the regulator. Some torches require a very delicate adjustment at the regulator for each size of tip, others are built to work with all tips at ordinary generator pressure of 12 pounds. Allow a little gas to flow through the torch to expel the air, then light it. More pressure is required to force gas through restricted orifices than where all openings are of large area. We are concerned with volume of gases, not pressures. The volume of acetylene passing through the torch should be sufficient to cause the acetylene flame (before turning on the oxygen) to burn without giving off smoke. For ordinary welding work the pressure should be between 5 and 12 pounds. Lower pressures do not force the gases into a

Continued on page 64

DEVELOPMENTS IN SHOP EQUIPMENT

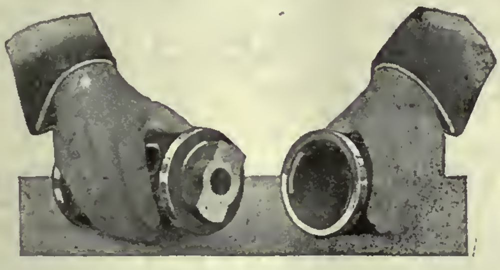
ROBERTS UNIT JACKS

The Roberts Mfg. Co., New Haven, Conn., handle a line of unit jacks and bolt couplers which should interest the mechanic in general. These jacks can be set to any height instantly by means of separate and interchangeable units. One merely builds up the proper number of units required and adjusts their rack jack. Lock joints connect each unit and are locked in place by means of a simple turn.

A surface gauge connection is also made, which can be clearly seen in the illustrations.

Readers can no doubt obtain all necessary details from a study of the various illustrations and will readily understand the advantages of such a system, especially for machine set-up work. All these jacks are made of first quality malleable iron, and will stand the strain placed on them in supporting work. These shop aids, as we might term them, are ideal for use on planers, vertical millers, horiontal mills, radial drills, boring mills, slotters, shapers, or in fact any machine upon which work has to be strapped in place. The erecting department will also find them of splendid service.

FROM LEFT TO RIGHT WE HAVE A TOOL-SETTING STAND, A LEVELING JACK, AND A SURFACE GAUGE CONNECTION.



THIS ILLUSTRATES THE LOCK JOINT. A SINGLE TURN FIRMLY LOCKS THE UNITS.

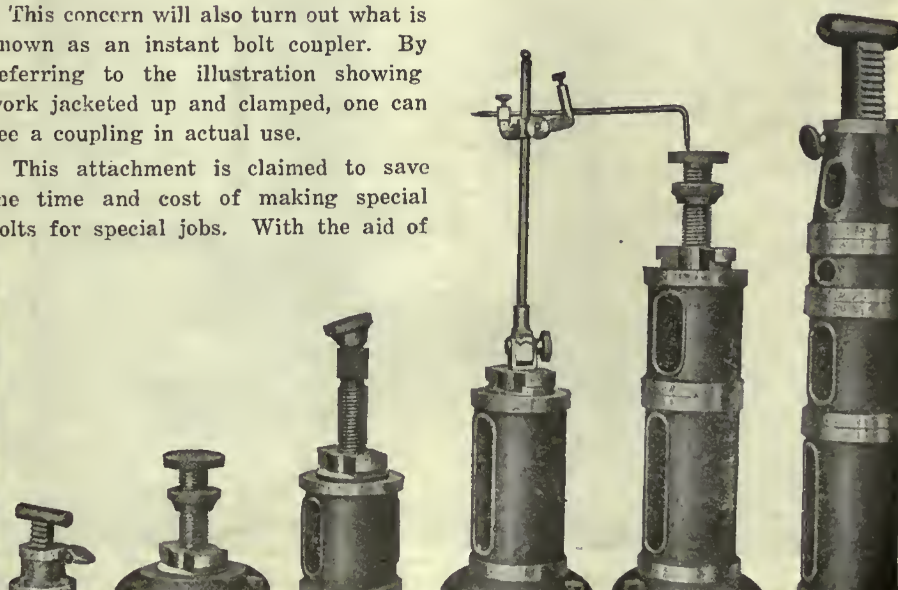
SOME EXTENSION UNITS AND RACK JACK.

This concern will also turn out what is known as an instant bolt coupler. By referring to the illustration showing work jacketed up and clamped, one can see a coupling in actual use.

This attachment is claimed to save the time and cost of making special bolts for special jobs. With the aid of coupler any length of bolt can be had by coupling up bolts you already have. Better still use studs for greater economy, for each bolt retains its own nut. These couplers are also made of malleable iron, and are designed to withstand high strains.

The L'Air Liquide Society announce that their plant at London, Ont., is now in operation, and producing at full capacity. This is the seventh plant in Canada to be completed, and at present there are two others in course of erection, one of which will be in operation within a month of two. This news will, no doubt, be of interest to those requiring oxygen for use in their plants.

ILLUSTRATION SHOWING BOLT COUPLER AND JACKS IN USE.



HERE ARE THE UNITS. THEY CAN BE BUILT UP TO SUIT THE JOB.

HORIZONTAL DRILL

The Milwaukee Crane and Manufacturing Co., Milwaukee, Wis., have plared on the market what is known as their Horizontal Drill No. 25. This machine is designed to cover a wide range of drilling and boring, and is especially useful in completing in one operation bulky and awkward work.

The spindle is of high carbon steel and accurately finished; the front bearing is 2½ in. diameter by 7½ in. long; middle bearing 2⅜ in. diameter by 6 in. long, and the driving end is 2¼ in. diameter with two beveled keyways. The front end is fitted with a ball thrust bearing and No. 5 Morse taper hole, arranged with special cross key and nuts for drawing up and releasing boring bars or tools and the spindle torque is not transmitted through the tang of the drill socket or boring bar when the work is heavy.

Spindle drill is of semi-steel, 4⅜ in. diameter, with heavy rack teeth cut for 24 in. feed, arranged to automatically cut out the drive when the spindle reaches the extreme in or out run of the feed range. Danger of stripping the feed mechanism by over-running when the feed is worked near the extremes of the run is thus eliminated.

The spindle is geared for standard speeds of 20 to 400 per minute, which may be increased or reduced when special service is to be met. With a 4 to 1 motor speed range and 16-point controller, 32 different speeds are obtainable with a sinkle back-gear ratio of about 5 to 1.

All gears are of steel, wide face, and carefully cut, run in oil and are supported on both sides by large bronze bearings arranged for ample and continuous lubrication. Power is transmitted through a maximum of only four reductions of spur gears to secure minimum boring speed and maximum torque, instead of the usual 8 or 9 pairs, thus permitting most of the motor power to reach the cutting tool without being used up by friction losses.

Spindle Feeds and Gearing

The standard spindle feeds provided are 9, 14, 20, 30, 50, and 70 thousandths per revolution. The feed is cut in or out by means of a trip lever and quick return or advance secured by means of the hand wheel on the quill-pinion shaft. Gears for change of feed are of steel and phosphor bronze, of wider face and heavier pitch than usually employed, and run in oil-tight case for constant lubrication. The quill drive worm wheel is of bronze, entirely covered, and the worm is of hard steel, running in oil.

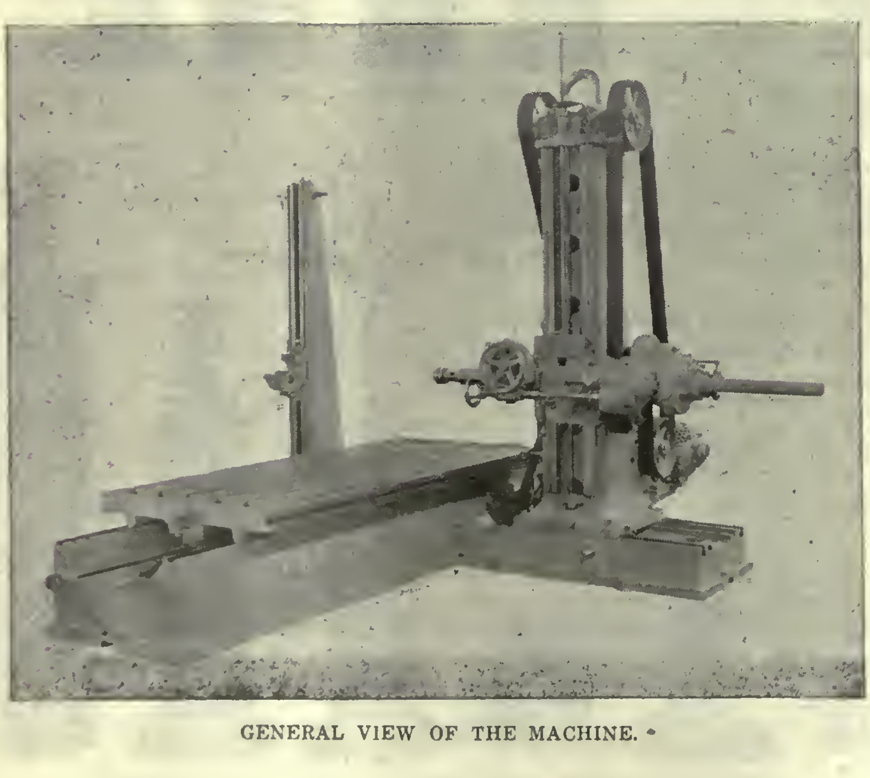
The carriage elevating and lowering mechanism is operated by power or hand and the driving gear is provided with a limiting torque clutch to secure safety to the mechanism in case the carriage is clamped too hard to the column when the power drive is thrown into gear. The hand adjustment is used only to secure final setting of the carriage. A steel scale on the face of the column indicates the distance from the top of the table to the centre of the spindle and a corresponding scale is carried by the outboard column.

The drill column is mounted on a side extension of the bed and is movable to or from the table to suit the size of the work and reduce the overhang of the spindle. This is an important advantage in many cases where end milling and facing is necessary and secures more accurate spotting of the drill than is possible with a long overhang.

The standard table furnished with this machine is 4 ft. wide and 9 ft. long and slides on a heavy, planed, cast iron bed 15 ft. long. The table is operated by a heavy screw operated by power and capable of easy and accurate adjustment by hand from both sides of the work. Suitable tee slots are provided for clamping the work or fixtures and the front edge of the table is tee slotted for bolting on special indexing plates or fixtures for accurately locating shaft bearings or other holes in duplicate work. Tables longer or shorter than the standard length can be furnished to meet special requirements.

The drill is operated by 3½ to 5 horse power, 4 to 1 variable speed motor. The starting, stopping and reversing lever is placed on the spindle carriage within convenient reach of the operator and the maximum floor space required, 14 ft. 6 in. x 17 ft. 10 in.

These drills are made in four sizes, Nos. 25, 30, 35 and 40, each size increasing in capacity and the No. 40 having a capacity of 72 in. elevation to table, and a column movement on base of 30 inches. Further information can be had from the manufacturers.



GENERAL VIEW OF THE MACHINE.

In a recent explosion of a 6-inch copper steam pipe at Carlisle, England, the findings of the official enquiry were as follows:

"The metal used being too brittle the explosion naturally followed. The analysis showed that the copper contained .027 per cent. of arsenic and .13 per cent. of oxygen. Tensile tests gave results varying from 12.4 tons to 14 tons per square inch, with elongations of from 25 to 33½ per cent."

A plate-bending roll which has recently been made in America is claimed by the makers to be one of the largest ever turned. It is 35 ft. 6 in. by 3 in. in the body, 40 feet 8 inches overall, and weighs 60 tons. The ingot from which it was forged weighed 119 tons, and was 67 inches in diameter.

One Way to Do It is to Put Your Good Ideas in This Paper

Hamilton, February 28th.

Editor, MACHINERY,

Dear Sir,—I wish to express a little thanks for the way Mr. Ernest helped at least one reader of CANADIAN MACHINERY by the small but practical subject: "How to Bore a Tapered Hole." I am sure such bright machine shop kinks as this are welcomed by all ambitious readers, and I, for one, hope to see more of them.

Wishing you all success,

Yours truly,

Hamilton Reader.

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PRINCIPAL CONTENTS

The Lesson For Canada

CANADIAN industry is being tied in knots because American railroads are tied in knots by the outlaw strikes in that country.

And Canadian industry is going to continue being tied in knots until this country wakes up to the fact that it is a long, dreary distance from being self-contained.

United States is becoming the stamping ground for agitators whose jaws work harder than their brains, and who would starve to death if they had to take their dirty hands out of the pockets of their fellows.

These men put a big crimp in the steel industry of United States last year, and that crimp passed right over into Canada.

These same men are throwing monkey wrenches into the railroad wheels now—on the other side of the line again. Railroad yards are clogged—traffic has become rusty—transportation companies don't transport.

And in Canada right now firms are wiring, writing and making personal trips to the strike-tied belt in United States.

We are paying a tremendous price for having year after year found it easier to reach across and get finished or semi-finished steel or iron than to get down to business and turn it out at home.

Transportation experts have laughed at the idea of bringing coal from the East or West into this coalless belt in the centre of industrial Canada.

And right now we have the spectacle of our finest steel industries, users of coal that must come from United States fields, being crippled to the point of banked furnaces and silent rollers—because the agitator has done his work, and because we have not seriously tried to annihilate distance in bringing our own ore and coal together in Canada.

Right now Canada stands facing empty markets at home and all over the world. There is so much business booked that it cannot be written off for months. It is not fictitious, nor imaginary. It is real, positive and legitimate.

And with all this in view the industries of Canada, for the lack of coal, steel and iron, have to stand aside and watch the opportunity go begging.

We have taken it for granted long enough that the great workshop of Canada—Ontario—was too far away from the coal fields of the West or the East. We have looked over the transportation figures and said "It's out of the question."

The punishment that Canadian industry has received on account of the outbreaks of strikes in United States should make our national comment read, "It must be done."

Surely our industrial head has been bumped on the pavement enough times in the last couple of years to cause us to wake up.

Otherwise we may feel around some bright morning, only to find that our feet have been frozen overnight.

Couldn't Earn $2.80 aDay

HOW things hop! Could you go out to-day and hire a moulder for $2.80 a day? You might not be able to hire one at any price, but certainly $2.80 would never get a hearing.

A moulder had answered an ad. of a firm in an Eastern Ontario town. He was making $2.50 a day, and was willing to leave for $2.80. He so informed the wise man from the East, and here is what he received in return.

The letter is dated June 3, 1909:—

Dear Sir,—

Your favor of the 1st to hand. The two places are already filled in my moulding shop for which I was advertising.

The applications which I have received are rather amusing. Moulders now-a-days do not know what to ask in wages. I do not believe it is possible for you to earn $2.80 a day. If any one could I would pay it, but I know that no moulder under me has ever done that yet. Nor come near it. Our moulders have steady work, every day the year round.

The sequel to the whole thing is that only a few weeks ago the same shop was advertising for moulders again, the wording this time reading "Highest Wages Paid."

Chance For the Skilled Man

ACCORDING to officials whose business it is to keep in touch with the situation, the fuel situation in Ontario, as far as power is concerned, is decidedly bad now.

Every ton of coal should be made to do, as near as possible, the duty of a ton. Steam plants, even at their best, are some distance removed from 100 per cent. efficiency.

The shortage of coal—and it is not apt to be remedied very soon—calls for the elimination of the tinker and the guesser in every department of the business that is touched by the production or transmission of power.

Industry calls for men who know—know how to get the best results from the fuel used—how to get results in transmission—how to eliminate as much friction as possible.

Increasing costs call for the same thing.

There's a great chance now for the man who wants to take himself by his own shoe-strings and pull himself out of the rut.

He may have to burn the midnight oil to do it—or he may have to burn the midnight oil if he doesn't, trying to figure out how to make ends meet.

Industry has not become simply a case of automatic production. You may get this idea at times.

The man who is going to succeed is not the man who contents himself with looking after the machine.

The man who succeeds is the one who is keeping a few paces ahead of the machine.

The night classes, the technical papers and books are still the real stepping stones to men who want to get into that desirable class that are called in after the average man has failed to give results.

MARKET DEVELOPMENTS

U. S. Railroad Strike Effects Are Felt Here

Many Canadian Concerns Depend on Shipments Coming Through From United States Mills—Premium Prices Are Still Much in Evidence in the Market—British Firms Are Getting Shipment Through Quickly

THE extent to which conditions in United States transportation systems are interfering with the steel, iron and machinery business in Canada is becoming more evident daily. The supply of coal is vitally necessary to the steel industry, and that is running dangerously low. One firm that needs 2,000 tons per day is getting about three or four hundred tons. There is a tremendous tonnage on the books of the steel mills and of the jobbers in Canada, but the big business is to make it or get it for shipment to the consumer.

Old Country representatives are reporting better service from their home offices in the way of deliveries, and some goods are reported as arriving in three weeks from the placing of the order.

Premium prices are still to the front. Toronto interests wanted plate within a short time, and had to pay 4.75 per pound at the mill. When extras for size, freight, duty, war tax and exchange were added to the price, as well as yardage and profit, it had to sell at 8.25 per pound. The U.S. manufacturer is getting the same material, if he is on the books of the Steel Corporation, at 2.65 per pound.

Another firm, anxious about boiler tubes that had been on the way for weeks, was informed by the mills that there were some 50,000 tons piled in the yards, and that the order wanted was probably in that pile. When that pile gets moved the Canadian customer will get his supplies, and there is not much indication of the movement taking place under present conditions.

New York machine tool market reports a falling off in inquiry that is quite noticeable. One explanation is that there is a very well-defined feeling that there must be an end to rising costs and increasing prices, and until there is some signs of a definite move downward in many essentials, buyers will persist in staying out of the market.

Steel mills and large melters have largely withdrawn from the scrap market in Canada, with the result that prices are flat and demand very small.

MONTREAL REPORTS BETTER DELIVERIES OF BRITISH TOOLS

Special to CANADIAN MACHINERY.

MONTREAL, May 20.—There are rumors in the air that steel prices may be easier in the near future, but it is difficult to state any good reason for such assumption, as conditions are not such as would lead one to believe that pressure has been relieved in any direction. The situation here is relatively the same as it has been for several months and dealers are still satisfied that receipt of materials will remain uncertain for some little time yet. The demand is still heavy and the inability to get steel material through for fixed deliveries continues to be a prominent feature of the present market. Roads in the States are in an unsettled state and traffic is still more or less congested, a condition that influences all industries that depend on transportation for requirements of raw materials and semi-finished products. Dealers state that occasionally they will get a little heavier shipment than usual, but are unable to place any in the warehouse owing to the urgent needs of consumers. The scarcity in sheets is probably the most pronounced, and tube users are continually asking for more supplies. It is thought that the situation will become easier from now on. Labor unrest is less evident, although it is still far from a condition where production is maintained at maximum. Dealers are invariably satisfied at the low state of stocks as the uncertainty leaves them nothing to worry over should prices decline.

Metals Slightly Easier

The metal situation shows a general tendency to weaken, as the reduced demand has created a temporary oversupply. Transportation difficulties have delayed deliveries but the general price tone is easier. Local dealers report a quiet week with a downward trend to prices. Tin is quite active with quotations easier, 70 cents being a drop of 2 cents on the week. Antimony has declined and is now quoted at 14 cents per pound.

British Trade Increasing

There is an increasing tendency on the part of dealers here to favor British-made machine tools when the delivery on American tools is a matter of several months. This is particularly true in the case of supplies, and in some instances a user of small tools has been given better satisfaction in the way of delivery when getting goods from England. A case in point was the receipt of a quantity of drills in less than three weeks from the time the order was given to the time the goods were delivered to the customer. It is thought that the release of tonnage control will be still more favorable to trade from Great Britain. The condition is still prevalent where old tools are made to fill the place of new ones when the latter are not to be had. Dealers are doing a good business in used machinery, although it is much harder to locate general purpose equipment as the bulk of this has long since been absorbed.

Non-Ferrous Scraps Weakening

It is stated that the consumption of scrap has fallen off as a result of the curtailment of furnace and mill operations, due to the inability to obtain sufficient supplies for normal operations. Whatever the reason, the present market is comparatively dull and trading is quiet. Local foundries are regular buyers, particularly of machinery scrap, but the supply is stil below the full requirements of the trade. Quotations on this class of material are high but listed prices are a fair average of what the dealers are paying. Non-ferrous lines are not very active and the market is weakening.

PAY THE PRICE TO GET THE MATERIAL

Premium Figures Dominate the Situation—Shipments of Some Machine Tools are Better

TORONTO.—In these columns a week ago, the observation was made that several of the steel warehouses had noticed a decided falling-off in inquiries. Some were inclined to think it was the forerunner of a quieter period, but most of the dealers are prepared to change their minds this week. Demand is strong, and there is insistent pressure for material from firms that are hard put to get enough to keep going.

Machine tool dealers are finding the embargo as big a problem as they have faced for a long time. Their usual shipping schedule is a fairly protracted affair at best—at least it has been for the past three or four years—and now that schedule is at the mercy of the railroads and their employees.

The fuel situation is a big topic of conversation in the machine tool market. The dealers apparently hear much of it from many of the customers, and it has much to do with the installation of new equipment. If a firm finds that power is not going to be available, the chances are that it will stay out of the market until some better condition is in sight.

The orders that are coming into the market here now are mostly from the smaller buyer, or from firms wanting to round out present installations.

The tie-up in the States in the way of transportation works out in queer ways at times. For instance, one dealer here who sells automatic lines, reports that he has had several machines sent across in advance of their promised schedule by several weeks. The reason was that there appeared to be no chance of getting them to their proper destination, a United States point, and it was found possibly to ship to Canada, so the Canadian buyer got the shipment.

Old country machine tool houses, now represented in Canada, report that their shipments are coming along better now, and they will be able to make deliveries in good season. They report good returns for the time they have been open in the Canadian territory, and find no trouble in placing all the machines they can get shipped.

Prices Continue Upward

A limited tonnage of plate (3-16) was taken in at one of the Toronto warehouses this week. The reason for the limited tonnage was the price, not the demand.

The buyer took on a tonnage for which he had to pay 4.75 base at the American mills. Delivery is to be made very shortly on this. How does this figure out by the time it goes out from the Canadian warehouse? Well, add ten per cent. for size, making 5.22; 35 cents duty which is at the rate of $7 per ton; 40 cents war tax; 33 cents freight charges, and 50 cents exchange. That brings the price of the plate to around 6.80. Then put on the cost of placing it in the warehouse, and add the profit of the dealer and the plate is selling at 8.25 cents per pound.

The Steel Corporation price has been all along, and still is 2.65, although it is not possible to get orders placed now, the mills being clogged with business that has been on the books for a long time.

Shipments to Canadian users are disappointingly meagre when compared to the absolute needs of the case. One firm in Hamilton has three or four hundred tons of flats and hexagons piled at the mills across the lines, and there they stay. They cannot be moved a foot.

There is no improvement in sheets. The Canadian mill is not sending many out now, on account of the shortage of coal. No. 28 are selling in the warehouse as 9.50 per pound, while 10 gauge is 9 cents.

Boiler tubes are coming in slowly. A few cars have arrived after long-drawn-out trip. One Toronto dealer in an effort to get some action on a shipment wired and wrote the mills. The reply was from one of the officials, and he stated that there were 35,000 tons piled at one side of the mill waiting a chance to get out, and probably his shipment was in the lot. That is as near as he could come to giving anything in the line of information as to where the Canadian shipment was. There is always an accumulation of orders against any shipment that may come. Big buyers come in many times, and ask that their orders be accepted at the warehouses. They know they cannot get attention right away, but they are willing to have their orders booked in the hope that the warehouses will be able to get better treatment from the mills than they can hope for.

A Dead Scrap Market

Dealers claim that the market is heading toward lower levels, although they were willing to let the price list stand for the present.

"Many of the big buyers in Canada are out of the market, especially in the steel business," was the explanation given to this paper, "and as a result the removal of the demand has caused the price tendency to point down." There is no change or let-up in the embargo situation, and any trading that is being done must be confined to this country. Very little exporting is being done.

POINTS IN WEEK'S MARKETING NOTES

New York reports a very quiet machine tool market and intimates that the feeling there is that there must be an end to rising prices and costs.

—

Steel mills are not able to get their finished material away from the mills as the switchmen's strike has seriously interfered with traffic. Passenger trains alone are operating on schedule.

—

Coal is not coming across the border in anything like needed amounts. Steel firms, for instance, that need 2,000 tons per day are trying to keep coking plants in operation on 300 or 400 tons per day.

—

Toronto jobbers had to pay 4.75 base for plate at U.S. mills for fair delivery. When all charges are paid it will be offered to the Canadian trade around 8.25 per pound.

—

The steel companies and large melters have largely gone out of the scrap metal market, with the result that prices are flat. Embargoes keep trading confined to Canada.

—

British importers report that they are getting much better service from their firms in the matter of deliveries.

—

Shipments of steel coming to Canada are being seriously interfered with. Some companies have not had a pound come in for as long as five days.

FALLING-OFF IN NEW YORK MARKET

Has Been Very Noticeable—Railroad Problem Has Caused a Serious Situation

Special to CANADIAN MACHINERY.

NEW YORK, May 20.—The falling off in machine tool business in the past two weeks has been rapid. The past week has been one of the quietest experienced in the Eastern markets in many months. The slump is largely attributed to the railroad situation. It is becoming more clearly recognized that railroad transportation will be the "neck of the bottle" industrially for some time to come. Statements of railroad executives to Government officials in Washington point out that the crisis in transportation is due not only to insufficient labor but also to insufficiency of freight cars. The roads are asking for funds to build 100,000 freight cars, but even if the money is speedily granted it will be many months before there will be any marked relief in that direction. Meanwhile traffic is becoming hopelessly confused. Should there be improvement in car supply and a more plentiful supply of labor to move trains there would immediately be immense offerings of freight, which has been piled up for weeks in warehouses and factories, and the result would be greater congestion. The solution offered by the railroads is action by the Interstate Commerce Commission restoring the priority arrangement which existed in war times. In this way priority would be given to essential products such as coal, food, etc., while other less needed articles would be carried only as the railroads were able to supply the cars.

A full appreciation of the railroad situation, together with a growing belief that a halt must be called on rising prices of all commodities, are no doubt at the bottom of the falling off in demand for machine tools. The same lack of buying exists in iron and steel and some other products, so that the present condition is not confined to any one industry.

Some sellers say that users of machine tools are of the opinion that the next change in prices will be downward. There are no positive indications at this writing of price declines; in fact the trend has been the other way right up to within the past two or three weeks. However, it may be said that there will be more conservatism henceforth in price advances on tools as well as on other articles.

The only inquiry of importance in the East is one issued by the Chesapeake and Ohio Railroad, calling for more than forty machines for plate shop, pipe shop and machine shop. Singularly, the principal business now pending and expected in the East is railroad business. The Norfolk and Western Railroad has not yet placed orders against its recent list of about seventy machines. Other roads, notably the Pennsylvania, Erie and Lackawanna are expected to come into the market shortly. Certainly if the roads are to get their rolling stock into shape to handle the freight traffic they must re-equip their shops, some of which have had practically no new tools since before the war.

PITTSBURG DISTRICT BADLY TIED UP BY STRIKE OF RAILROAD SWITCHMEN

Special to CANADIAN MACHINERY.

PITTSBURGH, May 20.—The rail strike has affected the iron and steel industry in a complicated manner. The strike itself has been waning, though very slowly, partly by the return of strikers and partly by the advent of new men, some of them volunteers, on temporary service. The full effect of this is not felt by the iron and steel industry for the reason that empty cars have been growing scarcer. From the beginning of the strike the effort has naturally been to load cars. The coal mines, coke works and steel mills gathered up all the cars they possibly could secure, many of them not being furnished by the railroads in the regular manner, but being simply gathered up by a plant sending out its own locomotives and picking up cars where they could be found. Main line tracks were idle in some cases, on account of the strike, and it was possible to do altogether unusual things in the matter of gathering up cars. Once the cars were loaded, however, they frequently did not get far. Some are still on plant sidings, while others have gone to railroad sidings and still others have gone to classification yards. It was said early in the strike that the railroad managements would make a particular point to avoid congesting their yards, but whatever the theory or intention the actual result has been different. Many yards are badly congested. Even in the case of the solid trainload movement, which has been employed so much, the solid trainload is merely one going out. There are few solid trainloads of empties being moved back. Of course there is no system or order. A trainload of coke from the Connellsville region is accompanied by a representative of the blast furnace, and the "personally conducted" train gets through, not infrequently by the distribution of bribes to the men working on the railroads, but similar efforts are not made to get the trainload of empties back.

The result of all this is an increasing scarcity of cars, which militates against freer shipments being made even though the avenues through which shipment could be made have been clearing.

The effect of these trends has been felt in some of the markets, most noticeably in the case of Connellsville coke. When the rail strike started, there were plenty of coke ovens and men, and a fair number of cars, while there were very few directions in which coke could be shipped. The market for spot furnace coke had been $11 to $12, and it weakened to $10.50 or possibly $10, as there were more sellers than there were buyers to whom shipments could be gotten through. Then the rails got more open, whereby more buyers could bid for coke, while the supply of cars decreased if it changed at all. The pressure turned to the other side. Coke became firm at $12, then within a few days got up to $13.50 minimum, next day to $14 and a day later to $15. Seeing no end to the advance some furnacemen withdrew from the market, preferring to bank rather than pay such fancy prices, as even $12 in its time had been considered a fancy price, and the market at this writing is about $15. It may be mentioned that foundry coke did not move similarly. Some brokers got as high as $14, but several old-line producers refused to go above $12, considering this the highest price that could possibly be regarded as fair, but they have been able to sell, and only in a limited way at that, to regular customers.

Steel Production

The monthly report of the American Iron and Steel Institute shows that in April the 30 companies that contribute to the monthly report made 2,638,305 gross tons of steel ingots, against 3,299,049 tons in March. These 30 companies produced 84.03 per cent. of the total output in 1918, and computing from this, and allowing for the number of working days the rate of steel ingot production by the whole industry in April is seen to have been about 37,550,000 gross tons per annum, against a rate of about 45,200,000 tons per annum in March, the March rate having been the highest attained since October, 1918. The decrease from March to April in the rate was one-sixth, precisely the same rate of decrease as was shown in pig iron, referred to in this report of a week ago. As the strike only began April 1 at Chicago, and did not affect Ohio and Western Pennsylvania points until Monday, April 12, while later in the month conditions in the Chicago district improved, the curtailment in production when the strike was at its worst was more than one-sixth from the March rate. It is doubtful whether production at the present time is greater than the average rate of April.

Shipments Poor

By this time, however, the trade has become much more interested in shipments or rather in receipts, than in production. Much more pig iron and steel is being made than is being shipped and much more is being shipped than is reaching destinations. Consumers are hard hit, not only by steel shortage, but also by shortage of coal and other necessities. Pittsburgh district coal, which was ranging from $4.00 to $4.50 per net ton at mine before the rail strike, has sold in the last few days at $7.00, and it may of course go still higher, as there are few cars and many anxious bidders.

The consumption of steel is certainly reduced very materially, although the precise amount cannot be estimated. Meanwhile steel is accumulating in mill warehouses and yards, and en route, the same being true of pig iron. These accumulations will doubtless have an effect upon the markets when the rail strike is ended, or rather when there is a free movement again, for ending the rail strike instantly would not entirely restore the movement of material, because there is so much congestion of loaded cars, and shipments with any freedom would not be possible until the loaded cars were delivered and unloaded and the empties gotten back.

Market Lethargic

The whole market is lethargic. Consumers have no occasion to buy prompt deliveries, for as a rule the delivery on a new purchase would be no better than delivery on an old purchase. As to forward deliveries, there is no interest.

In pig iron, the quotable market is strong, and in foundry pig there is a quotable advance of $1 a ton, to $44, valley, Bessemer remaining at $42.50, and basic at $43, but the foundry iron market is made simply by small prompt lots. What pig iron would bring for

second half delivery, if forced on the market, can only be conjectured.

As to steel prices, the prices for the earliest deliveries are declining, as the mills making such deliveries had little tonnage on books and must force sales. Mills booked for from two to four months, and having lower prices, though still say $10 to $20 a ton above the Steel Corporation or Industrial Board prices, have not reduced prices, but do not need to at this time. The Steel Corporation continues its prices. The corporation's unfilled obligations at the end of April amounted to 10,359,747 tons, showing 467,672 tons increase during April, against increases of 389,994 tons in March and 216,640 tons during February. Actual bookings in April, however, were lighter, as the greater increase in unfilled obligations in that month was due to decreased shipments, April shipments amounting to about 60 per cent. of capacity, against shipments in March at about 96 per cent. Bookings may be estimated at 124 per cent. of capacity in March and 94 per cent. of capacity in April. When the bookings of the low seller decreased it may readily be concluded that the bookings of the higher sellers, the independents, decreased still more.

SERIOUS MATTER FOR THIS COUNTRY WITH COAL SHUT OFF

CANADIANS, who have returned this week from points in the steel belt of United States, bring back reports of congested yards, of freight trains that do not carry freight and of shipments that have fallen by the wayside. The switchmen's strike is as effective as it ever was, and the results are such as to interfere seriously with the securing of basic materials by Canadian mills.

The amount of coal passing over the border during the last three months is away down when compared to any ordinary period of similar duration. Steel mills in Canada, in some cases, depend entirely on United States fields for coal for coking purposes. The fact that the mines belong to them does not help matters if they cannot get the product of the mines in here.

Several blast furnaces have been down for some days, if not weeks, and finishing departments are getting along as best they can without any regular movement of material from the furnace to them. The big danger is that if things do not improve quickly some of the by-product coking plants will go down, and closing these off is a serious business, as coking, once started, is of necessity a continuous process.

There is a lot of business on the books of the steel companies in this country, and it is all good, legitimate business, placed there by people who want steel products for manufacturing or building. The pity of the thing is that, more and more, due to labor troubles carried on on the other side of the line, Canadian industry is being crippled and retarded, just at a time when it is in great shape to go ahead by leaps and bounds.

One Canadian steel man, who came back to-day, told CANADIAN MACHINERY: "The switchmen's strike is on just as effectively to-day as it ever was. Production in Pittsburgh I would place around 40 per cent., while the same figure would hold good in Youngstown as well."

HOW ONE AMERICAN FIRM HAS ADOPTED A FIFTY-FIFTY PLAN

The Willys-Overland Company's "50-50 Profit Sharing Plan" in connection with its factories in the United States goes further into the realm of profit sharing than has been attempted in the great majority of these experiments. The distribution between capital and labor is made on an equal basis after capital has been justly rewarded, and provision made for the depreciation, etc. An amount equivalent to 3 per cent. of permanent capital is set aside for depreciation; 1 per cent. applies to a contingency or "Rainy Day Fund." The just return to invested or permanent capital is estimated at 7½ per cent. Payment of these amounts is made from the income of the year and the residue is shared equally between capital and the workers. This plan was tried as an experiment and has been in operation for a year and a half. It will be continued each year after 1920 if it proves satisfactory. The company believes that with the consistent co-operation of its employees the "50-50 plan" will work out successfully. The firm does not assume any additional legal obligations, nor do the employees sacrifice or imperil any of their rights. The fact is emphasized that the plan shall in no wise affect either the rights of the company or the rights of its employees. It is a purely voluntary arrangement on the part of the company and its employees. Every worker who has been in the employ of the company for a period of ten months becomes a profit sharer.

The employee's record of conditions service is not affected by absence on account of sickness or injury. Absence from work for two consecutive days or three times in thirty days without report, automatically removes an employee's name from the continuous service record.

To take charge of this work a 50-50 division was organized, composed of ten members, five of these selected from the factory, who submitted best written suggestions on profit sharing plans. These ten members hold office for one year and their successors are elected annually.

Profits are distributed on the basis of salary and no wage is considered in excess of $5,000 per annum. Length of service is also rewarded. Five distributions of profit are made each year. The first four are based on a conservative book inventory and the fifth on the regular annual inventory.

NO COAL BOATS

Formerly a Large Amount of Coal Has Come Up This Way

MONTREAL.—This season not a ton of coal will be brought to Montreal in the Black Diamond ships by the water route from Louisburg to Montreal.

When asked when the first shipment of coal was likely to be unloaded in port from Nova Scotia or Cape Breton, a Dominion Coal Company official said:

"No coal boats are coming to Montreal this year."

The reasons given were firstly the great demand made for the coal on the spot by big industries like the Steel Corporation, whose consumption has increased tremendously.

This factor has become aggravated by under production in the mines. The high cost of bunkering in Britain, which compels British vessels to fill their bunkers at Sydney instead, is also an important factor in the present drastic changes.

PLENTY OF POWER

Report Says That Trent Valley Resources Capable of Great Things

PETERBORO.—At a meeting of the Engineering Institute Mr. Sisson presented a verbal report on behalf of the committee appointed to investigate the power situation in the Trent Valley. It contains some interesting figures on the supply of power and was coupled with the suggestion of Mr. Sisson that, although there were at present sources of power for double the present population of Peterborough, yet a year from now the city might have to look for new sources of additional power, which will unquestionably be forthcoming.

He stated that in the Trent Valley there was power available to the amount of 70,000 h. p., of which, up to the present, only 28,000 had been developed. In connection with this latter figure, Mr. Sisson pointed out that his figures referred to the power actually produced and not to the total capacity of the installations and machinery.

Quebec.—A most successful launching of the "Canadian Hunter" took place from the Davie Shipyards, when a large number of interested spectators watched the vessel glide into the water. The "Canadian Hunter" has a length of 331 feet, breadth 46 feet 6 inches, a depth moulded of 25 feet 6 inches, and a speed of 12 knots. Her deadweight is 5,100 tons.

CANADIAN MACHINERY
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Interesting Examples of Sheet Metal Dies

Designers and Practical Men Alike Will No Doubt Welcome This Article—Some Very Good Hints Can be Derived From a Study of the General Design of These Dies

By J. H. MOORE

WHEN we speak of the art of punching sheet metal we mean this in every sense of the word, for the efficient working and punching of sheet metal is indeed an art. To efficiently cope with the peculiar problems arising from such a class of work requires years of experience.

The International Harvester Co., Ltd., Hamilton, Canada, are especially fortunate in this respect, for their experience is not only a matter of years but of varied classes of work. It is a well-known fact that a great number of parts used on agricultural implements are made from sheet metal, and it is this fact that prompted us to secure photographs of the dies illustrated in this article.

Before going into the question of the dies themselves, let us consider a few features that make the sheet metal department itself worthy of note.

On entering the department one is first struck with the orderly appearance of all presses, shears, etc. Every machine is laid down according to a well-thought-out plan, and sufficient aisle space is allowed for trucking purposes.

Every machine is painted at certain portions with aluminum paint. The object is obvious, namely that the aluminum paint catches the light and reflects it back on the work. By so doing there are no dark corners to any machine and the value of this idea is not as fully realized in the machine shop of to-day as it should be.

At present some 1,100 to 1,200 different styles of work pass through the department. The need of a proper system to keep track of the dies is at once apparent. This is accomplished in two ways. For the smaller dies, special shelves are made, and these shelves being divided into certain sections. Depending on the nature of the die, it goes into its proper section, and in every case the symbol number of the piece is painted on the die itself. There is no possible chance for error and all dies are easily kept track of. The larger dies are stored in a room specially set aside for the purpose.

Having explained these little details, which are so important to any well-conducted department, we will proceed to the question of the dies themselves.

Revolving Oil Cover Die

The first to be considered is that of a revolving die used in producing the oil hole cover shown at Fig. 1. We not only illustrate the dies but show the stock itself, from the flat shape to the finished product. The first operation is that of piercing the two small holes, cutting the peculiar shaped form of the bosses around these holes and the blanking of the pieces itself. This is done by the die shown at A and B. At A is

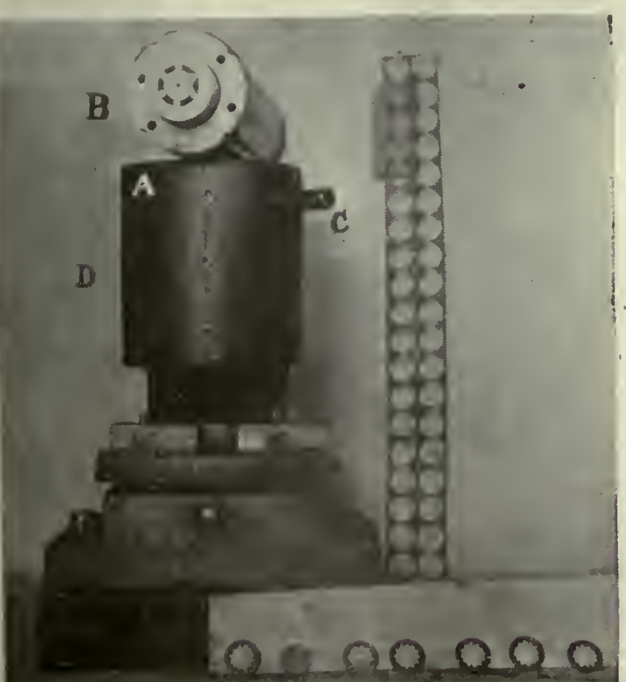


FIG. 2—THIS DIE IS USED FOR SERRATING WASHERS AS SHOWN.

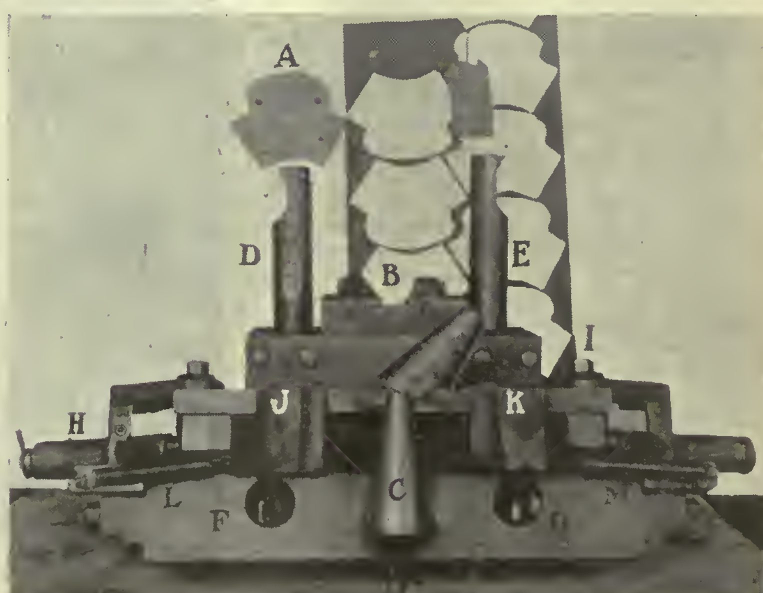


FIG. 3—A DIE FOR FORMING TUBE SPOUT.

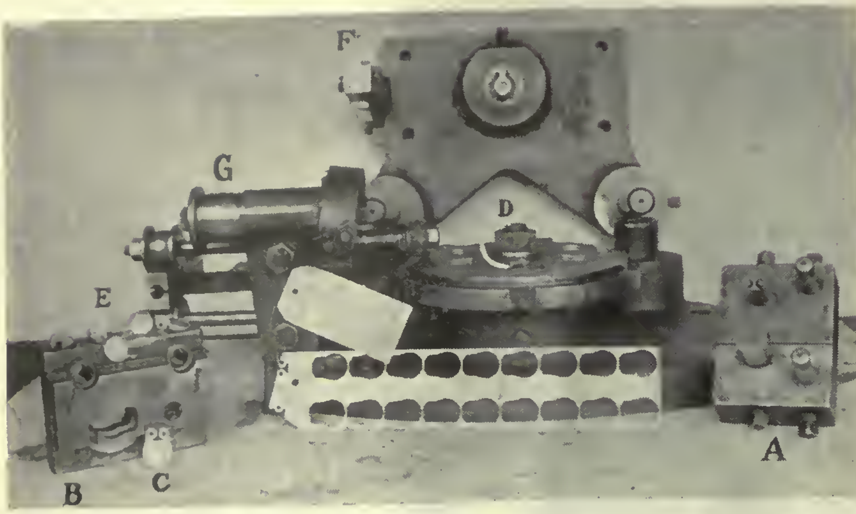


FIG. 1—A GOOD GENERAL VIEW OF A REVOLVING OIL COVER DIE.

shown the upper punch block, while B illustrates the lower part of the die. It will be noticed that guide pins are employed for the work, and it might be well to state that guide pins are practically standard for all dies of this type, that is, as far as this plant is concerned. After the die has performed its duty the piece looks as shown at C. Next comes the work of the revolving die. This die has six stations, each being indexed in the following manner. The operator loads at station D, or perhaps we had best say at position D, as the stations are continually revolving. Down comes the punch and forms the cover to the shape shown at E. The plunger F kicks a trip and releases the friction trip on the table, causing it to revolve to the next station. All this movement has occurred while the plunger has been ascending, so that by the time the press is ready for the down-stroke the next station is indexed and in position for the following piece to be formed.

By this method production is uninterrupted, as the trip lever of punch press is depressed in down position to make the strokes continuous. It will be noticed that guide pins are also used in this die.

The table receives its circular motion through a belt driven over the pulley G, which in turn operates the friction device. A point of interest regarding work passing through this department is the fact that a sample strip of every piece is kept on file. This strip is shown for illustrative purposes, and as will be noticed is clearly tagged with its proper symbol number.

We do not wish readers to imagine that all the stock shown at centre portion of strip is going to waste, for such is not the case. The only reason this large space was allowed to exist was in order to make the sample strip of sufficient strength to prevent bending.

Serrated Washer Die

The next die we will consider is that shown at Fig. 2. Here we have what is known as a washer serrating die. We again show the sample strip alongside the die. The process of manufacture is also shown at A. The die is constructed on the sub-press principle, or in other words it is really double in its action.

The plunger illustrated at B contains both the blanking punch and the serrating punch. A spring and thrust pin at the top of this plunger does the operating. This pin is shown partially out at Co. Briefly here is the action: The ram of press descends, presses down the plunger B, and blanks out and serrates the washer at the same stroke. It will be noted that there are twelve serrations in the washer. To prevent the plunger B revolving, the keyways shown slide up and down on pins in the interior bore of portion D of the die. The plunger is also arranged to strip each washer automatically.

Tube Spout Die

We will next discuss the die shown at Fig. 3. This is what is known as the dies for forming spout, or tube end for seed tube. It is constructed on the kicking principle and actually kicks the piece into its form in the following manner:

The blanked piece, shown at A, is placed in position B, and is gauged from the pins, which are clearly shown in photograph. The ram of press, carrying the upper holster, descends, pressing the nose punch C into position, causing the tube to take a U-shaped form. The two pins, D and E, in the meantime have engaged with a trip in the holes F and G, which releases the side kicking arms H and I, the result of course being obvious. These arms come in and operate the side dies J and K, completing the form of the tube.

While this description takes some time in telling, the actual operation is accomplished very fast indeed. The action is really so speedy that one has to watch a few pieces being formed before they can thoroughly grasp the principle.

The springs shown at L and M bring back the side dies after each piece is formed. This arrangement is so out of the ordinary run of dies that readers will do well to study it carefully.

Large Punching Die

The fourth and last example is shown at Fig. 4. The work being performed is that of punching the various holes in the binder deck of a harvester binder. There are a total of 32 holes in this piece and for explanatory purposes we have

FIG. 4—THIS DIE PUNCHES A TOTAL OF 32 HOLES

shown one of these decks resting on the floor at the front of the die. One can readily see the variety of holes, which include 7-32 in. dia., ½ in. dia., ⅜ in. sq., 1 in. sq., and the two peculiar shaped holes noted at the left-hand side of the deck.

The upper of these holes is made up of sists of a ¼ in. wide strip enlarged to gether with a semi-circular portion of an 8 in. diam. hole.

The other hole is 9 in. long and consists of a ½ in. wide strip enlarged to 1½ in. width at top and bottom. From these dimensions it is readily seen that these holes are no sinecure to blank out.

As is usual with all of this nature in the sheet metal department, guide pins are provided, and these pins being grooved for good lubrication when the ram is ascending and descending. On a close examination of the photograph it will be seen that the ram of press is of white color. This is because the ram is coated with aluminum paint. The added amount of reflected light obtained through this means is surprising, and other plants would do well to try this method.

From the form example given one can form at least a slight idea of the variety of pieces passing through this particular department, and in a later issue we will touch on other points of interest in connection with this plant.

How Should We Lubricate Ball Bearings?

Ball Bearing Lubrication is a Subject of Which Little is Known —This Article, Presented at the American Society of Mechanical Engineers, Touches on Some Interesting Points on This Subject

By H. R. TROTTER

AN investigation of existing literature on the subject of ball-bearing lubrication reveals the fact that up-to-date a comprehensive study of this particular phase of lubrication has not as yet been published. The efficient lubrication of the plain sleeve-type bearing presents few difficulties, as the engineering world is in possession of an accumulation of data acquired during many years of patient study, experiment and practice.

In 885 Beauchamp Tower completed a series of experiments which he had made to obtain data regarding the behavior of a lubricant under various loads and speeds. These experiments were made at the request of the British Institute of Mechanical Engineers, and were later made the subject of a very thorough mathematical analysis by Prof. Osborne Reynolds. The outstanding feature of these experiments was the discovery of the wedge-shaped film of oil. Prof. Reynolds gave the rue for efficient lubrication, which is that where two surfaces are in sliding contact a satisfactory film of oil cannot be maintained unless the surfaces are a slight inclination to each other.

The formation of such a wedge-shaped film of oil can be described as follows: In Fig. 1 is shown a pan or tray A containing a small amount of oil. A at plate B is loaded with weights C. When in a stationary position the surfaces of the plate and pan are parallel to each other, but if the plate is now pulled along the surface of the pan the leading edge will rise and the plate will flow on an oil film with the surfaces at an inclination to erach other. The oil film assumes the shape of a wedge, as shown in Fig. 2.

The iMtchell thrust bearing, which is manufactured in Great Britain, and the Kingsbury thrust bearing, made in this country, are designed to take advantage of this phenomenon and both have proven very successful. The main features of a bearing of this type are shown diagrammatically in Fig. 3. A is the rotating member. B is the stationary member. The parts C are supported on pivots D. A bearing of this type with a diameter of 18 in. will successfully accept a thrust load of 160,000 lbs. at a speed of 35r.p.m. Loads of approximately 10,000 lbs. per square inch of bearing surface at a mean surface speed of 54 ft. per sec. have been carried successfully on short tests on a bearing of this type. At this load the babbitt facing of the blocks owed in all directions without temperature rise, thus showing that the pressure limit is controlled by the strength of the metal, and not by the breakdown of the oil filmfi.

The oil grooves of a sleeve type bearing should be of such shape as to allow the formation of this oil wedge. Fig. 4 shows a correct groove and Fig. 5 an incorrect groove. When forced feed lubrication is used, the oil should enter the bearing at a point of low pressure and not at the bottom of the bearing which is near the point of maximum pressure. The oil grooves in a sleeve-type bearing are generally made wedge shaped and not of semicircular section, as experience shows that this is necessary to the formation of the lubricating film. The oil inlet in a force-feed bearing is placed at a point which is approximately the point of lowest pressure and not at the bottom of tmhe bearing. Successful bearing operation is a problem shat should be solved by the designer and not by the lubrication engineer who acts in an advisory capacity after the bearing is in service. It must be admitted, however, that the average engineer is not in possession of the necessary data which would enable him to select the proper type of lubricant for his partncular use, nor has he the instruments or appliances to analyze a lubricant both physically and chemically.

The final choice of a lubricant is at best the result of a compromise between the engineer and the chemist. The compromise is very often unsatisfactory and due in part to the chemist's inability to thoroughly comprehend the engineer's

With increase of	Where the viscosity is effective the coefficient of friction	Where the body is effective the coefficient of friction
Pressure	Decreases	Increases
Speed	Increases	Decreases
Temperature	Decreases	Increases

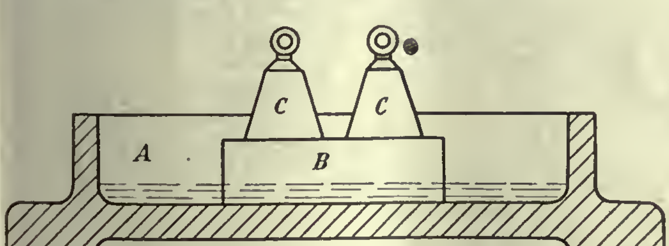


FIG. 1.

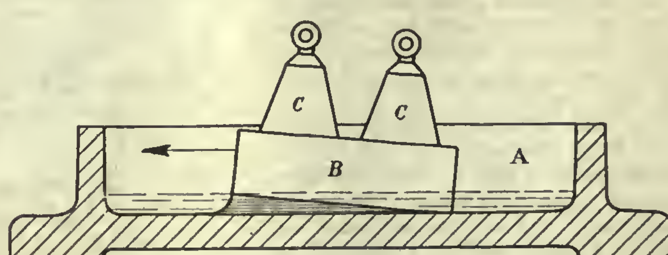


FIG. 2.

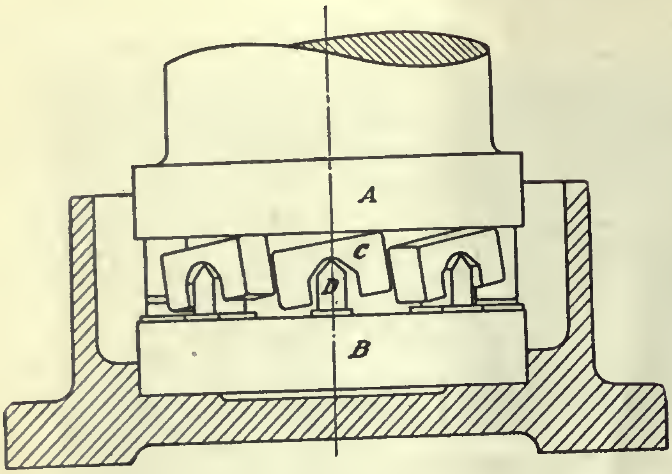


FIG. 3

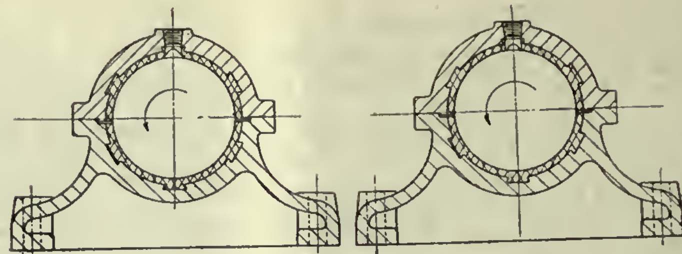


FIG. 4

problem and in part to the engineer's lack of chemical knowledge.

The Testing of Lnbricants

At the present time there is, unfortunately, no instrument which will accurately indicate the true lubricating value of an oil or grease, and until such an instrument is devised, the selection of a lubricant must be more or less a matter of guesswork. A viscosimeter gives a comparative reading of the inertia of a liquid, but it does not indicate the value of a lubricant under working conditions. Furthermore, all authorities are not agreed on the desirable qualities of a lubricant. Many claim that a high surface tension is a requisite and others lay great stress on adhesive qualities. All are agreed, however, that a lubricant should have the minimum of internal friction. Generally speaking, the requirements of a lubricant for the plain sleeve type of bearing are a certain amount of adhesive quality to enable it to adhere to both the revolving and stationary surfaces. It should have sufficient body to withstand the pressures. The lubricant film will therefore consist of three layers, which in operation approximate the features of a ball bearing in that one element is stationary, one rotating and one an intermediate layer consisting of globules similar to the balls in a ball bearing. From this description the importance of body in a lubricant will be realied, and as thez best and toughest material is required in the balls of a ball bearing, so is body required in the intermediate layer of a lubricant.

Body in a lubricant cannot very well be defined. It seems certain that its effects are opposite to those of viscosity. Professor Kingsbury gives the following relations of viscosity and body (Trans. Am. Soc. M.E.., Vol. 24, 1903, page 147):

The author has designed an instrument which may possibly be the means of obtaining data of value regarding lubricants. This instrument is shown diagrammatically in Fig. 6. The appliance consists of a revolving element driven by a small motor and a stationary element similar to a block used in a Mitchell or Kingsbury bearing with suitable means of obtaining readings of the inclination angle of the block to the revolving element.

At one time it was considered necessary to support the blocks in a Mitchell or Kingsbury thrust bearing at a point behind its center of figure in order to secure the wedge of oil between the opposing surfaces. Furthermore, it was assumed that if such a block was centrally supported, it would possess no load-carrying capacity. Independent experiments by Professor Kingsbury and Sir Charles Parsons established the fact, however, that a centrally pivoted block could carry considerable load. This was an important discovery, as most of the applications of Michell and Kingsbury thrust bearings have been on marine propeller shafts where reverse rotation is necessary. It was later found that with a centrally supported block the wedge-shaped film of oil was due to the change of viscosity of the lubricant when passing through the block. It will thus be seen that the ankle which the block assumes to the rotating member gives an indication of the change of viscosity in a lubricating film when in operation.

Referring again to Fig. 6, "A" marks a casing consisting of an inner chamber which contains the lubricant to be tested and an outer chamber containing oil which is electrially heated and which transmits its heat to the inner chamber. At "B" is shown a small electric motor with a shaft extension on which is placed a flange, the face of which is highly polished. The motor swings on a pivot "C" which allows the flange to take various positions withrelation to the block, thus enabling readings to be taken at various rubbing velocities. By means of the lever "D" various pressures may be obtained. The movement of the block is magnified by minimeters and transmitted to the dial indicator. Holes are drilled in the block and can be connected to a manometer to obtain pressure readings, or as there is practically no pressure difference, the holes can be connected to each other in such a manner that there will be practically no velocity through them. Temperature maybe obtained at the leading and trailing edges of the block. Readings may be taken at constant speed with varying loads or with constant loads at varying speeds. While the author is not certain as to the practical value of such an instrument, it is at least a step in the right direction.

Operating Characteristics of Ball Bearings

The two cardinal points of successful sleeve-bearing operation are:

A design of such a type as will permit of the formation and preservation of an oil film.

Selection of a lubricant that will provide a fim of maximum strength with a minimum of internal friction.

With a ball bearing, however, the problem is not so easily understood,

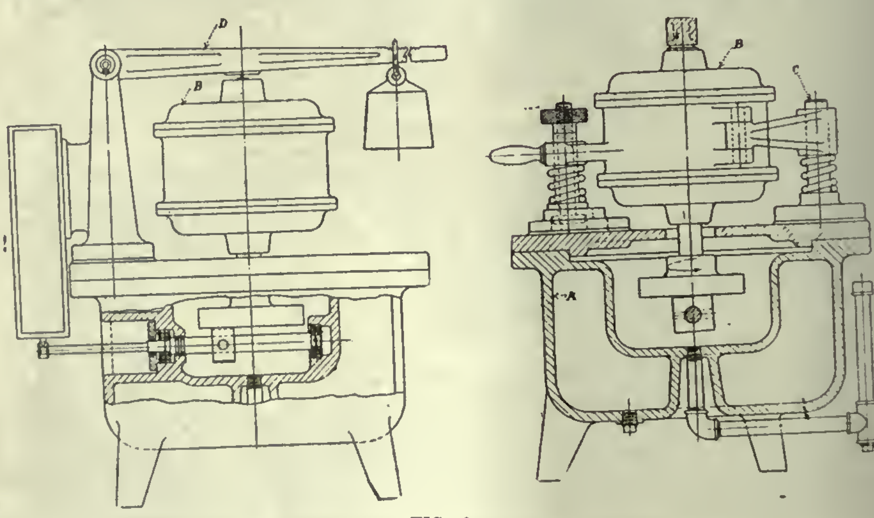


FIG. 6

but the important points to be remembered are:

The coefficient of friction is practically constant throughout wide ranges of loads and speeds.

Metal-to-metal contact (an oil film only possible at very high speeds when slippage may take place).

The coefficient of friction is lower in an unlubricated ball bearing (at light loads and moderate speeds).

The first point is, of course, generally known, but the conclusion to be derived from this point has not been stated before to the author's knowledge, namely, the impossibility of an oil film between balls and races.

In Fig. 7 curve "A" shows the change of friction coefficient of a plain bearing under constant load and varying speed. This curve is self-eplanatory and shows that a satisfactory oil film is not formed till a certain speed is reached. In the same figure curve "B" gives the friction coefficients of a well-made ball bearing, and shows that the friction loss of a ball bearing is practically constant throughout wide ranges of speed. If an oil film were formed between balls and races, curve "B" would possess the same general characteristics as curve "A."

The difference between the friction coefficient of a lubricated and unlubricated ball bearing is shown in Fig. 8. This property of a ball bearing is not generally known and should not be used as an argument in favor of operating ball bearings without lubrication. From the foregoing statements it should be evident that plain bearings and ball bearings possess such radically different characteristics that a true comparison is impossible. It naturally follows, therefore, that practically all the accumulated experience of the lubricating engineer is of little value when analyzing ball-bearing operation.

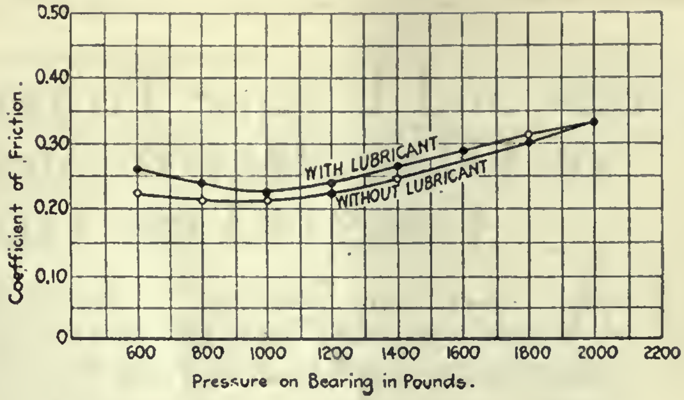


FIG. 8

Requirements of a Ball-Bearing Lubricant

The use of a lubricant with ball bearings is necessary to protect the highly polished surfaces of the balls and raceways and to minimize the slight friction between the balls and ball retainer. The small amount of friction between balls and retainer can also be minimized by careful design. The principal requirement of a ball-bearing lubricant is chemical neutrality. The lubricant used must not contain over 0.10 per cent. acid or alkali. There are many commercial lubricants on the market which come within this limit, but very few are acceptable because of their tendency to develop acid with age or when operating at high temperatures.

Most of the high-grade oils can be used with safety, but many of the lubricating greases, while suitable for general purposes, are a positive menace to successful ball-bearing operation, not because of poor material used in the manufacture of greases, but because of the lack of scientific mixing methods. The manufacturer is in no way to blame for this condition because he is making grease for general commercial use and not for ball bearings. There are now on the market a few greases manufactured especially for ball bearings, but, with one exception, all those tested by the author have proven worthless and clearly indicate the maker's ignorance of the requirements.

Experience shows that the most satisfactory lubricant for ball bearings is a highly refined mineral oil having the proper viscosity and cold test for the installation. Greases should be used only where operating conditions require viscosities greater than can be obtained with a mineral oil.

Whenever a ball bearing is operated at high speeds it is not advisable to run it submerged in a lubricant, and provision should be made to supply the oil from a pressure system. If such a system is not available, good results may be obtained by a large sight-feed oil cup. A few drops of oil per minute is all that is required.

At moderate speeds a heavy oil will generally give better results than a light oil. The substitution of a heavy oil for a light oil will generally result in a decreased operating temperature. This peculiarity may be explained by the fact that when the bearing is running at the actual operating speed, less opposition is offered to the rotation of the balls by the oil because of the inertia of the oil. In addition there is less churning and frothing, with their resultant air pockets. Air pockets in a lubricant act as insulators and prevent the transmission of the heat generated to the outer casing where it can readily be dissipated.

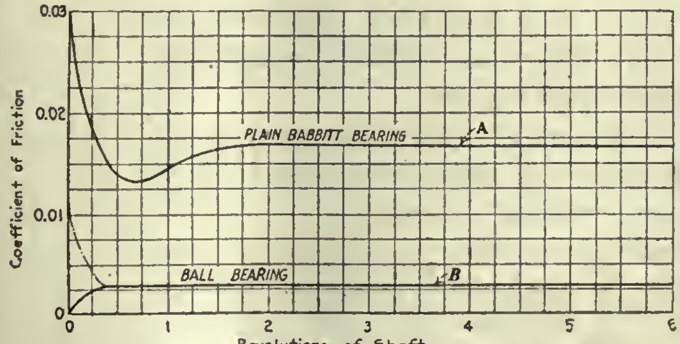


FIG. 7

All mineral oils used on ball bearings should be highly refined, filtered, and contain a minimum amount of acid, alkali or sulpho compounds, and in order to insure the use of such oils the following specifications are suggested:

Free acid (calc. as oleic acid), maximum, 0.10 per cent.

Free alkali, absent.

Ash, maximum, trace.

Heat test (15 minutes at flash point), slight darkening, but no sediment.

Flash point (Cleveland open cup), minimum, 300 deg. Fahr.

Fire test, minimum, 350 degs. Fahr.

Viscosity at 100 deg. Fahr., Saybolt Universal:

Light oil	100 to 200 sec.
Medium oil	200 to 300 sec.
Heavy oil	300 to 500 sec.
Extra heavy oil .	More than 500 sec.

Free Acid Test.—The test for free acid should be made in accordance with the method of the American Society for Testing Materials, which is as follows:

Accurately weigh 10 grams of the oil into a flask, add 50cc. of 95 per cent. alcohol which has been neutralized with weak caustic soda, and heat to the boiling point. Agitate the flask thoroughly in order to dissolve the free fatty acids as completely as possible. Titrate while hot with tenth-normal alkali, using phenolphthalein as indicator. Express results as percentage of oleic acid. 1 cc. N/10 alkali = 0.0282 gram of oleic acid.

To be Continued

Unfair and Unwise Proposal for Increase of 300 to 500% to Meet Increased Costs of Less Than 100%

A DRASTIC increase in postal rates, amounting to 300% the first year, and 500% the second year, is proposed in the resolution of Hon. Martin Burrell to increase postal rates on second-class matter from ¼ cent per lb. to 1 cent per lb. in 1921, and 1½ cents per lb. in 1922.

The reason given for this terrific increase of 300 to 500 per cent., is that the railroads have been awarded a higher rate for carrying mail matter. *This increase, however, is less than* 100%. Salaries of postal officials have been increased. *These increases have been less than* 100%.

The Government may need increased revenue, but why inflict a 300 *to* 500% *increase* on second-class matter, when increased costs of salaries and transportation are less than 100%?

A similar percentage increase in first-class mail would increase the cost of minimum rate for letters from 3 cents to 12 cents in 1921 and 18 cents in 1922.

When the Government reduced the rate of postage some 20 years ago on second-class matter from ½ cent per lb. to ¼ cent per lb., and at the same time reduced the letter rate from 3 cents to 2 cents, the result was not a deficit, but a surplus, and the first surplus the Post Office Department had shown for years. These reductions in rate of postage were accompanied by increases in salaries to postal officials, and also by regulations which eliminated much unnecessary waste.

A low postal rate was granted on second-class matter to encourage establishment of Canadian newspapers and periodicals. Is it fair when publishers have invested large sums of money to suddenly reverse the policy and make a drastic increase in rates which will ruin many worthy publications, and cripple the service given by the majority which survive?

Every dollar added to the price of a magazine narrows the circle of readers, and the men who would fail to subscribe are the ones who need information most.

This drastic increase would place a crippling tax on the periodical press, which, next to the schools themselves, is the greatest educational power in the country.

It would seriously retard our development in agriculture, in trade, in manufacturing, in medicine, science and engineering by restricting the spread of information essential to development in these lines. This retardation would result in a tremendous annual loss to the country — a loss far greater than the revenue which the proponents of this measure (erroneously, we believe) expect.

The Canadian publishers of magazines, religious and educational papers, farm papers, trade and technical papers are already working under handicaps not experienced in other lines of business. They are subject to what is equivalent to "dumping" on the part of American publishers of magazines. The very large production by American magazine publishers takes care of the overhead expenses so that each can quite easily provide for an additional 5,000 or 10,000 copies for the Canadian market at relatively small additional expense. This extra run for the Canadian market is dumped into Canada by freight or express absolutely duty free.

The Canadian publisher must provide for his overhead with a much smaller circulation and is subject to additional expense amounting to over 40% represented by the Customs Tariff on equipment and supplies used in the production of his magazine.

Canadian National Magazines circulate to a total of approximately 5,000,000 copies annually. As against this we have a total circulation in Canada of American weekly and monthly magazines of approximately 20,000,000 copies annually. Would it not be in the public interest instead of further penalizing Canadian magazine publishers to provide even greater encouragement such as would tend to promote a much larger circulation of distinctively Canadian periodicals?

Seven years ago Canadian publishers asked for an investigation of cost of carrying various classes of mail matter, but this has not taken place. We believe such an investigation would bring out many ways in which economies could be effected.

The public has always been keenly interested in educational matters. We believe they would object strenuously to any further percentage of increase than is justified by increased expenses. In no case is this higher than 100%.

The work of magazines, business and religious papers should not be crippled to make up deficits in other departments. They should not be penalized to the extent of 300 to 500%. The increase in postal rates on Canadian publications should not be more than 100% at this time, and it would be obviously unfair and demoralizing to enforce the proposed increase of 300 to 500%.

Here is How The Whitthall Co. Produce Tin Cans

It is Reasonably Safe to Assume That the Average Reader Has But a Slight Conception of the Intricate Equipment Necessary to Produce Tin Cans—This Article Tells You How

By J. H. RODGERS

PROBABLY few articles of a domestic character are more familiar to the public eye than the ordinary tin can in which at the present time, so many different foods and household necessities are prepared and distributed for constant use.. It is reasonably safe to assume that few people have but a slight conception of the intricate mechanical equipment that is essentially necessary for the commercial production of the simple tin can in such quantities that enables them to be used, economically, as containers for a great variety of product. The material itself is the greatest factor in the cost of its manufacture.

The modern method of manufacturing tin cans requires machinery that is practically automatic in every detail of its operation, so that when once adjusted for a certain size of container the sequence of production, while the can making process is in progress, is absolutely continuous. To the casual observer the rapidity with which the semi-finished cans travel along the conveyors from one machine to another, is at first a mystifying sight, but closer observation dispels the magic atmosphere and one then sees the mechanical regularity of each and every detail, and can soon follow the progressive steps from the flat sheet to the loading of the finished product in the railroad cars.

Accuracy is the keynote of successful production. This is equally true in the making of a simple tin can as in many other lines where the finished product is of much greater value. The dependence of one machine upon another makes it almost imperative that every semi-finished can shall be perfect and an exact duplicate of the one preceding it, as a short hold-up in a run of ten thousand cans will soon wipe out the profit of manufacturing.

The A. R. Whittall Can Company, of Montreal, is a typical example of the progress that this industry has made in the last decade. The business was started by A. R. Whittall in 1885 and the activities have steadily increased under careful management and supervision. The initiative of the company was shown by the fact that they were the first Canadian firm to start work on a war order, this having been received on August 4th, 1914. The amount of this first order was for one million cans, and the total volume of business for war purposes was 200 million cans of all sizes.

F. R. Whittall is the managing-director of the company, D. S. Whittall is the vice-president, the father of these boys being A. R. Whittall the president and starter of the original business.

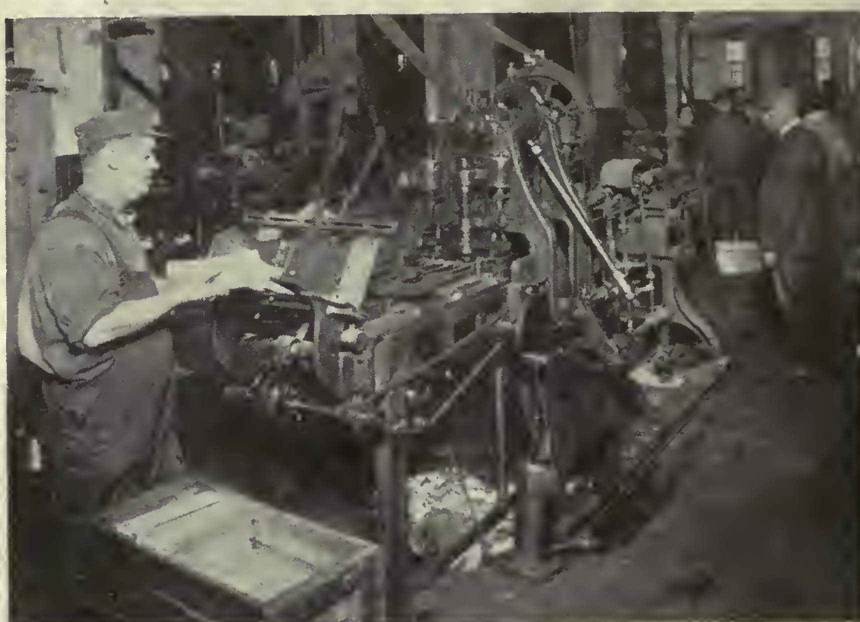


FIG. 2—BODY-MAKING MACHINE FOR THE SOLDERED LINE.

The Soldered Can

Ordinary commercial cans may be made by either of two methods—the soldered or the sanitary—the latter having supplanted the former to a large extent during recent years, by the con-

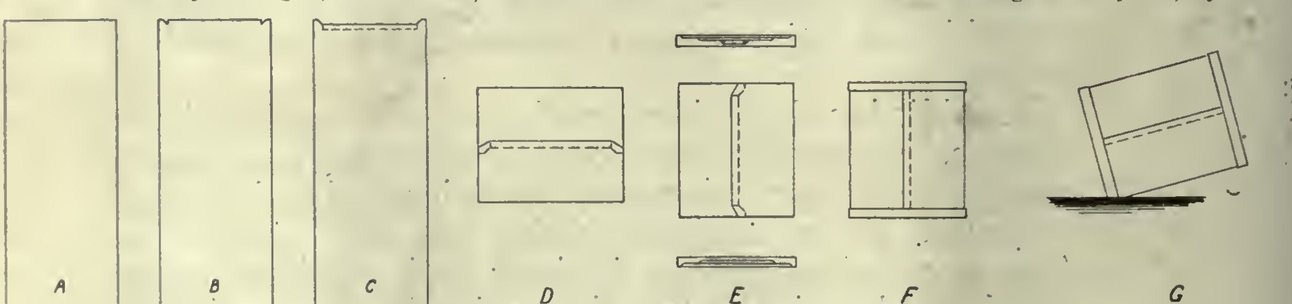


FIG. 3—THE NOTCHING AND FOLDING OPERATIONS.

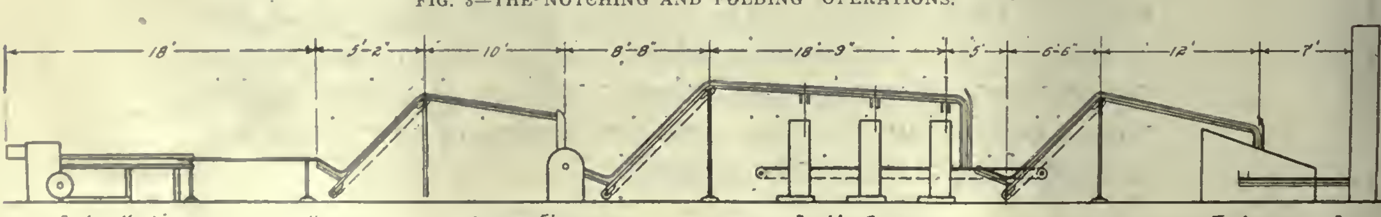


FIG. 1—A SKELTON LAYOUT OF A SANITARY LINE.

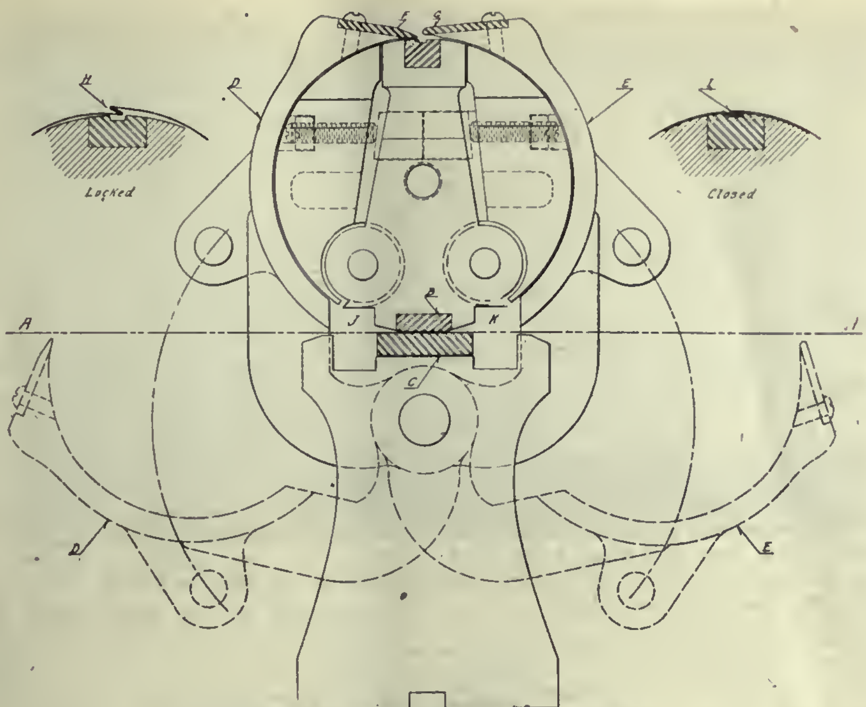


FIG. 4—THE ATTACHMENT FOR BENDING THE FLAT SHEET TO CYLINDRICAL SHAPE.

tinual development and improvement of suitable machinery. The Whittall Company are equipped to manufacture cans of every description, an automatic installation having been provided for each type of can. A skeleton layout of a sanitary line is shown in Fig. 1. The arrangement of the soldered line is quite similar to this, with the exception that the header replaces the flanger, and the corresponding position of the double seamers is occupied by the "floater" that solders the heads to the bodies.

With such a large variety of cans manufactured no attempt will be made to describe any particular size or make, as the process in every case is almost identical. In a product of this nature the factor of waste is a serious problem, and careful supervision is necessary in the selection of the different sizes of sheets from which the various cans are to be made. The cutting of the body blanks would appear to be a simple undertaking, and in fact it is, but the greatest care is required on the part of the operator in the adjustment of the gages and the spacing of the slitting cutters. so that absolute uniformity is attained. The smoothness of all succeeding operations depends, very largely, on the accuracy of the setting of the slitting shears. From four to six bodies may be cut at the one passing of the sheet; any two blanks thus cut must be of such exact dimensions that when laid upon one another they will not vary in the slightest degree.

Making the Cylindrical Body

After the body blanks are cut to size they are placed in a hopper at the receiving end of the Slayman body-making machine, shown in Fig. 2. This hopper is adjustable to different sizes of blanks and is set on an angle of about 30 degrees so that the force of gravity keeps the pile pressed against the side stops at the lower end of the incline. When the machine is in operation, a bell-crank, fitted to a shaft underneath, swings upwards and a small rubber cup secured to the upper arm, presses against the blanks in the hopper, and by the vacuum created a single blank is removed and lowered to the table, where it is carried along by fingers to an oscillating slide. The blanks are carried forward to a position where the corners are notched out, as shown at B in Fig. 3.

When this operation is performed the blank is moved along to the next stationary position, where the edges are folded as shown at C in Fig. 3. The next movement brings the blank to the forming blocks, where the flat sheet is bent to a cylindrical shape and the edges locked. A sketch of this attachment is shown in Fig. 4. When the blank is moved into position it coincides with the line A-A, passing below the mandrel and between the steel blocks B and C, with the swinging arms in their lowest position, as indicated by the dotted outline. When the blank has been carried to the proper position the pushing fingers are withdrawn and by the action of a crank and connecting link, the swinging arms D and E are moved upwards, thus forcing the blank around the mandrel. When in a closed position the steel strips F and G force the locking of the seam. This is shown in detail at H. Immediately the arms swing outward the seam is bumped from above and finished as shown at I. The mandrel is adjustable so that any slight variation in size can readily be obtained. The cylindrical body

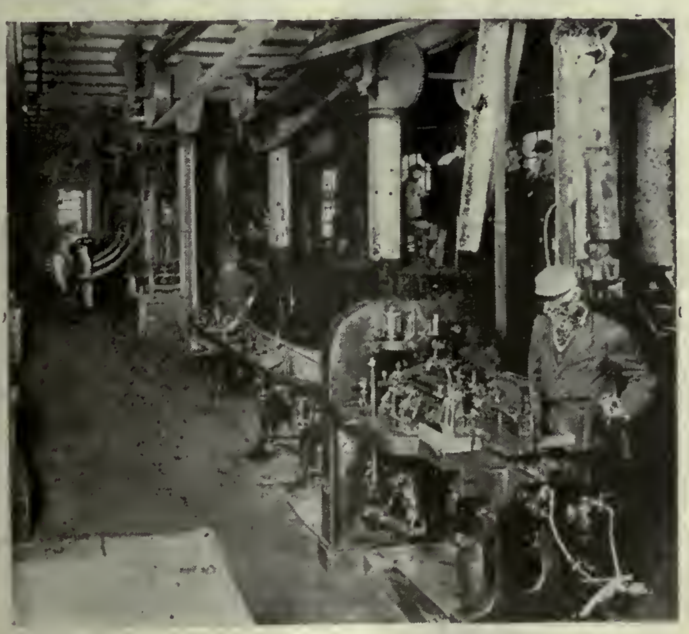


FIG. 5—BODY MAKING MACHINE ON THE SANITARY LINE.

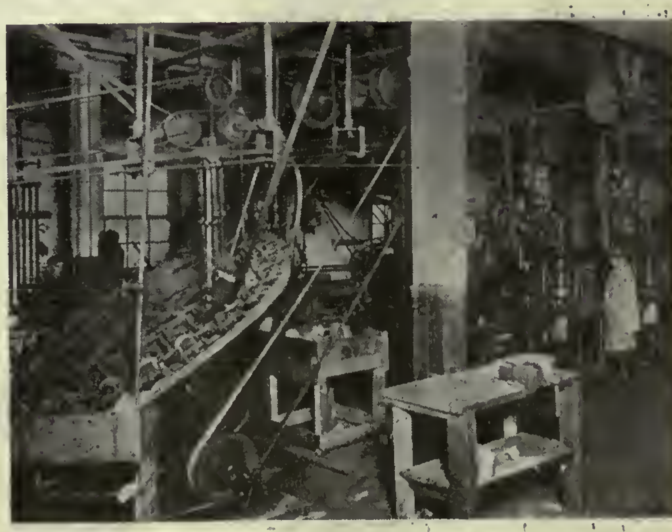


FIG. 6—TESTER AND DOUBLE SEAMERS ON SANITARY LINE.

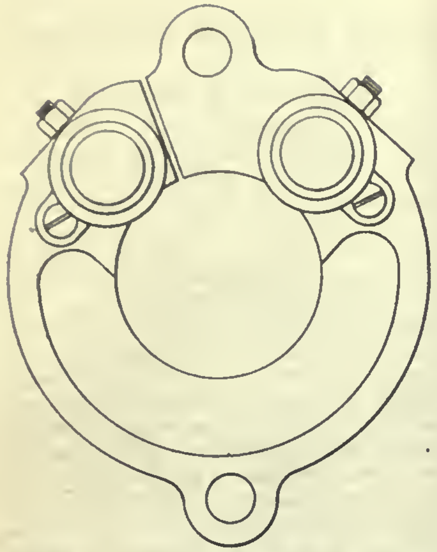


FIG. 7—THE DOUBLE SEAMING RING.

is then pushed off the mandrel by fingers operating in the spaces J and K, and is carried over an arbor and beneath a gas jet, where the joint is soldered, wire solder being fed automatically and in just sufficient quantity to provide a well-sealed seam.

The semi-finished can now has the appearance of D in Fig. 3, and is passed along below a pipe from which a low pressure air blast is supplied to cool the tin. The body, now completed, passes from the arbor, and by means of a small finger at the end of the machine, is turned at right angles to its previous position, and rolls into a chute, from which it is conveyed over the fluxing rolls and elevated by means of a conveyor to a gravity runway that leads to the heading machine.

Putting on the Ends

Simultaneous with the movement of the can bodies to the heading machine, is the delivery of the tops and the bottoms. A raised platform is located between the body-making and the heading machines, for the purpose of placing the tops and the bottoms in their respective runways. The platform, with four girl operators, can be seen in the upper right background of Fig. 5. The bodies are delivered down a central chute to the intermittent revolving head of the header, while the tops and bottoms are delivered to either side; the progress at this stage being shown at E in Fig. 3, and that after heading, at F. The top and bottom are now in position and all that is required to complete the actual making of the can, is the sealing of these circumferential joints by soldering.

Soldering on the ends

This operation is accomplished in a machine known as a floater, which is provided with a bath of molten solder, kept at a constant temperature of about 600 degress F. As the tin comes from the header a conveyor carries them to the top of an incline, down which they roll by gravity to one side of the floater, and by the weight of an endless chain travelling over the tops of the cans, the latter are caused to roll at an angle of about 15 degrees, while the corner dipping into the solder bath, similar to that shown at G in Fig. 3.

At the discharge end of the floater the can is lifted clear of the solder and allowed to roll down a short incline and under a rapidly revolving brush that removes all the surplus solder from the joint, leaving it smooth and clean. Continuing in the conveyor, which is now given a half-turn twist, the cans are returned on the opposite side of the floater and the other end given the same treatment as the first, and after again passing through the cleaning brushes, the cans are practically completed.

Testing the Finished Cans

While the process, so far, constitutes a description of the actual making of the cans, the efficiency of the various operations has yet to be determined. When the tins are to be used as containers for foods, or as receptacles for liquids of any kind, it is essential that the cans be perfectly air-tight, otherwise leakage will result, and in the case of cooked foods, the contents would undoubtedly spoil. To insure a 100 per cent. perfect shipment from the factory every can for such purposes as stated above is given an air test by passing the cans through a tank of water, the open end of the can being sealed to prevent the water from reaching the interior. The operation of the tester is one of the most interesting of any of the machines in the factory and performs its work accurately and systematically. One of these machines is shown at the left of Fig. 6. The overhead runway will be noted above, with

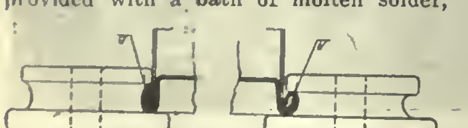


FIG. 8—THE CURLING ROLLS.

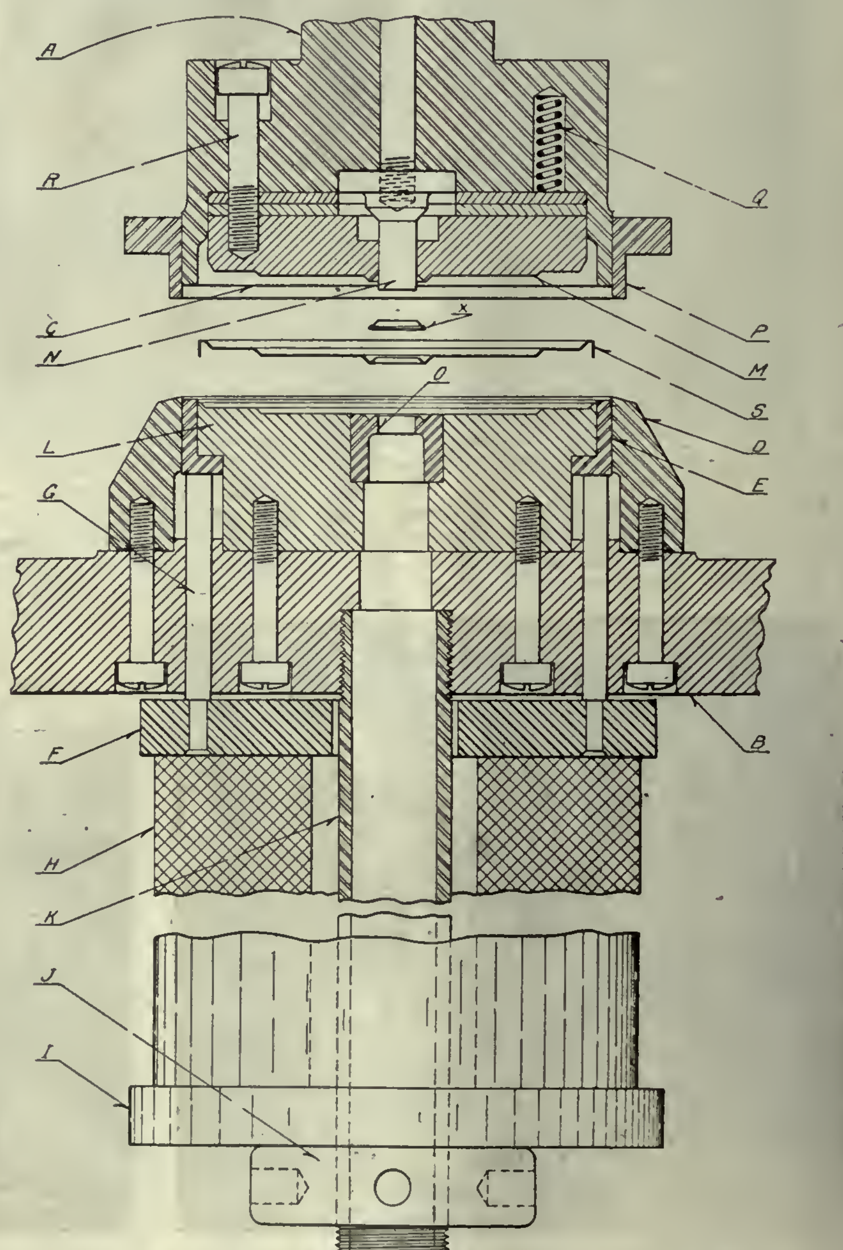


FIG. 9—COMMON METHOD OF MAKING PUNCH AND DIE CAN COVERS.

FIG. 10—GENERAL VIEW OF A PORTION OF PRESS DEPARMENT.

a vertical chute leading down to the machine. The revolving portion of the machine is set at an angle of about 30 degrees and has position for some 24 tins, the lower section being charged at all times. These testers are adjustable to take all sizes of cans up to one gallon.

As the machine revolves a can drops into each position and immediately afterwards the rubber head is pressed against the open end of the can by the action of a cam below the revolving head; at the same time the air valve is turned on, permitting air at a pressure of 15 pounds to enter the can. In this position it passed through the tank of water, and it is the duty of the operator who sits in front of the machine, to watch for the small air bubbles that indicates that the can is defective. Directly back of each sliding head is a small handle which can be turned when a defective can is detected, the result of this action permitting the can to be discharged automatically at a different point from those that are perfect, the latter being released by the disengagement of the roller of the cam and carried by conveyor to a drier, through which they pass before being carried to the waiting cars for shipment. Cut-outs are provided at various points in the conveyors to divert the cans when any of the machines are suddenly thrown out of commission.

The Sanitary Can

In the sanitary made can there is considerable more accuracy required in the various machine operations, owing to the fact that no solder is used in sealing the seams. Apart from the soldering of the longitudinal seam the making of the cylindrical body is identical with the soldered type of tin, a special body-making machine being used for this purpose. After coming from the lock seamer the cans are taken by conveyor to the flanger, where the ends are given a slight flare to facilitate the operation of curling the stock inside the flange of the cover when these are put on in the double seamers. Three automatic double seamers are used in the sanitary line, each machine having an average capacity of 60 cans per minute. A partial view of these machines is shown at the middle right of Fig. 6. Directly in front of the machine is a four-post magazine guide into which the covers are placed, and kept supplied by the operator when the machine is working. The covers, one at a time, are taken from the bottom of the pile automatically, and carried inwards and placed on the bodies as they are fed into a central position beneath the head of the double seamer. By the action of a cam, properly timed, the table, with the can, is raised, thus pressing the cover into the head of the revolving spindle, which trabels at a constant speed of 600 r.p.m. The operation of double seaming is performed by the action of the ring shown in Fig. 7. This ring is secured to the seaming head and by means of an eccentric on the outer sleeve of the spindle, and revolving in the vatio of about 1:30 of that of the main spindle, causes the two rollers to oscillate from side to side, the first roller giving a curl similar to that at A in Fig. 8, and the second or finishing roll completing the seam as shown at B. It will be noted that the ring, which is made of steel, is split alongside the second roll. The clamping screws provide a rigid support to the first roll, while the cut gives sufficient flexibility for the finishing roll when passing over the side seam, at the same time making a good tight joint. By means of a small eccentric bushing in the ring, the position of these rollers is accurately adjusted for any slight variation in the thickness of the stock or the wear of the rolls. The rolls run on roller bearings to insure perfect freedof of action under heavy pressure..

FIG. 11—AN OUTLINE VIEW OF SANITARY COVER AS IT COMES FROM THE DIE.

Stamping Out the Covers

In order to complete the description of the manufacture of a tin can it will be necessary to give a few details in

FIG. 12—SPECIAL CAN-MAKING DEPARTMENT.

FIG. 13—VIEW SHOWING PORTION OF TOOL ROOM.

connection with the making of the tops and the bottoms, an operation that is accomplished on one machine, and invariably at one stroke of the press. Dies of the desired shapes and sizes are essential to the production of tin cans; the various sizes to provide for the different characters and volumes of the contents, and of such a shape as to insure strength and stiffness to the ends, and at the same time provide facilities for fastening to the cylindrical portion of the can.

The general principle of circular die construction is quite similar in all cases, although the details of design may vary vary according to the needs of each individual case and the method practised by the designer. The sketch shown in Fig. 9 illustrates a common way of making a punch and die for can covers, this particular one being for a cover of a soldered can with a small central opening for filling. (After filling, the small solder-edged cap X is placed on and sealed with a capping iron, this operation being done at the factory of the manufacturer putting up the contents.)

To describe the operation of making the cover S. The first detail is the placing of the punch and the die in the press; this is done by the die-setter, and great care is required in securing the die to the press bed, as the alignment must be absolutely accurate, to avoid shearing the die, and likewise to produce a perfect cover. The strips of tin, from which the covers are to be made, are cut about 1-8 inch wider than the diameter of the blank cut. These strips are fed over the die and the press set in motion; covers being produced at the rate of about 150 per minute. When the blank is cut it is firmly held between the face of the punch C and the face of the draw ring E. To provide the proper pressure to prevent buckling of the stock when being drawn into shape, the ring F is provided, with pins G extending through the die bed and bearing against the lower part of the ring E. The tension proper is supplied by the rubber cylinder H, surrounding the pipe K and supported on the ring I. Pressure is adjustable by the nut J. The stock is formed with the desired concentric impressions by the contact of the punch plate M and the forming post L, over the outer diameter of the latter the edge of the cover being formed. Just before coming to its lowest position the centre hole is pierced by the punch N as it enters the small die O, the blank passing down through the central opening. The cover is removed from the punch by the reaction of the springs Q, and from the forming post by the pressure ring E.

A view of the press department is shown in Fig 10, the presses on the right being fitted with automatic feeding attachments. The output from one of these presses will approximate 90,000 covers per day of ten hours. Several presses are operating continuously on the making of tops and bottoms. The dies for the sanitary tops or covers are somewhat similar to that in Fig. 9, but modified to meet their specific needs, the presses are adapted to the use of an extra die that gives the additional curl to the end for facilitating the double seaming operation.

It might be stated that for sanitary cans that are to be perfectly air tight, the covers are passed through a special machine where a thin film of liquid rubber is spread inside the curl that is afterwards seamed to the body. This greatly adds to the efficiency of the seam. An outline of a sanitary cover as it comes from the die in which it is made, is shown in Fig. 11, the arrows indicating the portion treated with the film of rubber.

In addition to the section devoted to automatic production of the standard types of smaller tins, a special department is provided to take care of the larger sizes, where considerably more manual labor is required on the different operations. Fig. 12 shows a view of this department.

One of the indispensable factors in the maintenance of a sheet metal working plant is that of the tool room. Generally speaking, every new type or size of can necessitates a complete set of tools for its production. This applies in particular to the tops and bottoms, so that the making of the dies for this purpose is no small detail of the plant requirements. The tool room at the Whittall factory is exceptionally well equipped and amply provided with every facility for effective production of sheet metal dies and all kinds of accessories for can making machinery.

ONE WAY TO LOSE MONEY

It was reported from Buffalo that if scoopers do not return to work within a reasonable time the Lake Carriers' Associatioon in all probability will declare an open shop in grain handling, and proceed to organize for handling the fall grain. There is little possibility of any of the old housemen or scoopers going to work at grain handling this spring, say vesselmen. "The scoopers have lost a good deal of money by having been led into this sympathetic strike. The grain will all have been unloaded in a short time, and these men will not have earned a dollar. They had no grievance against the vesselmen, but quit because the housemen were out," said President T. V. O'Connor of the International Longshoremen's Union.

According to Commerce Reports, copper mining is, next to diamond mining, the most important industry in Southwest Africa, and one which had been steadily expanding for some years prior to the outbreak of the war. Copper deposits occur and have been opened up at quite a number of widely separated localities. Many of these, however, have not proved worth exploiting, and the only properties that have been worked on a profitable scale are those belonging to the Otavi Mines & Railway Co. at Tsumeb, Guchab, Great Otavi, Asis, and Otavi Valley; the Kahn Copper Mine, situated to the southeast of Arandis; and the Sinclair Mine, in the northeastern corner of the Luderitz Bay district.

The Tsumeb deposits are said to be the most important so far discovered. These are found on a limestone hill, where the ore body is 550 feet long and 65½ feet wide. The ore consists of copper glaance and lead ore, and also of carbonates of copper and lead. The ore is concentrated and smelted until a 40 per cent. copper ore is obtained after the separation of the lead.

Although iron ore has been found to exist in a number of localities the only deposit that has been exploited up to the present is situated near Kalkfeld, on the same railway line as the Tsumeb copper mine.

The Chamber of Commerce of Newcastle-on-Tyne, England, is issuing a volume in five languages descriptive of the industries of Durham and Northumberland.

The declared exports from the consular district of Callao-Lima, Peru, included the agencies at Arequipa, Cerro de Pasco, Mollendo, Salaverry, and Paita, amounted to $53,489,799 in 1919 as compared with $39,480,887 in 1918, an increase of $14.008,912. There was a decided increase at Callao and all of the agencies with the exception of Mollendo, where the exports of tin ore, wolfram, and wool decreased considerably.

WHAT OUR READERS THINK AND DO

Repairing a Double Throw Crankshaft

By W. R. GREEN

WHILE in the employ of the company who made the bullwheel described in a previous article of CANADIAN MACHINERY, I, with an older machinist, was sent to a nearby mine to look over a broken-down engine with the object of locating the trouble and making an estimate of the price for repairs. After getting to the place we discovered that the engine was a two cylinder, end crank, with flywheel centre mounted. We also found that the engine required new cylinder liners, new pistons, and the piston rods turned down, also one new slide valve. The worst trouble, however, appeared to be that the crankshaft seemed to have a slight kink in it near the right-hand main bearing.

The engineer stated that it had been like that for weeks and was caused by the big rope breaking and tangling with the flywheel and jamming between the wheel and the pit wall; instead of the wheel breaking, the shaft kinked. He mentioned that if he had shut down a large number of men would have been out of a job, so, as the engine could still run, although with a slight wobble, he kept it so doing till the season closed and the mine shut down.

Well, Joe and I went all over the parts and sent a letter in to our super, with an estimate of the job, reserving the crankshaft for a daywork job; meanwhile we, with the engineer and fireman, cleaned the dirty parts and dismantled them ready for the ore train to take them to town.

By the time the parts were ready for shipment one of our boilermakers passed us the word to get it down to the shop. After getting back to the shop again my job was to straighten the crankshaft with the aid of the blacksmith, so after cleaning the shaft thoroughly with kerosene and a moulder's steel brush, I took off the split sheaves (eccentric) and the two cranks and hoisted the shaft onto the home-made overhead crane and rambled it down to the big forge where the smith took it in hand. I now returned to the machine shop to secure some tackle ready to jack the shaft into line.

In the meantime the shaft was getting hot and presently the smith called me over to the forge to look at something he couldn't savvy, and to tell the truth I was as badly scared as he was at what I saw in the fire. You will see by Fig. 1 what the shape of the crack was that we saw on the hot shaft, and I presumed that when the wheel got jammed, the shaft (which was very old) cracked, and the peculiar shaped chip wedged in, and later on the space it left on the journal filled with hard babbitt from the bearing, so it was not noticed until the heat melted off.

We decided that we had better show it to the foreman and see what he had to say about the affair, and he, on looking it over, advised us to put it aside and look around for a piece suitable for making another shaft. After wasting two days looking for a large solid shaft suitable for the job, I had to report failure.

There were plenty of pieces of large stock but they were all hollow. I then suggested that the shaft be repaired by reducing the size of it and thread-shrinking a new jacket to it. I had seen a similar job accomplished while working in Woolwich Arsenal, England, as an improver, and it had been a perfect success, although it did not get the strain put on it that a crankshaft does.

He suggested that it be welded, but after talking it over with the smiths he found that the forges were not large enough for that size of work, and also it would require a large power hammer, which we were shy of at that time.

After talking it over with the older men the owner told me to make a good, clear drawing of the shaft as it was, and also of my proposed scheme, which I did. After looking at the drawings the foreman told me to go ahead, and also mentioned that if it was no good I would be presented with the order of the "can."

I now took the shaft to our large screw-cutting lathe, chucked it at one end and mounted it in a steady rest fitted with two hardwood blocks about four inches back of the right-hand end of the wheel mounting. Next I placed a long inch-and-half hole up the centre of shaft giving it a slight outward taper near the end in case I would need a centre later on, in which case I would have fitted a taper plug in the hole. I next run the back centre up with a small pipe centre fitted to it and after taking the weight from the steady rest, I reset the same, as the two-wheel keyways were cutting the blocks. I filled the keyways with babbitt and stopped that trouble. Then I started the real work, by reducing the flange, journal and shaft to 7 inch. dia. and right up to the wheel hub spotting. The crack did not extend clear through, but had the appearance of a flat wedge chip in the steel which had tired or crystallized.

I now took the shaft to our large and then gave all three steps a final cut, which gave the thread clearance and allowed about one inch under each shoulder for an eight-pitch thread. On the foreman's advice I left the shaft for a time before threading it, taking the entre from it and taking belt off lathe,

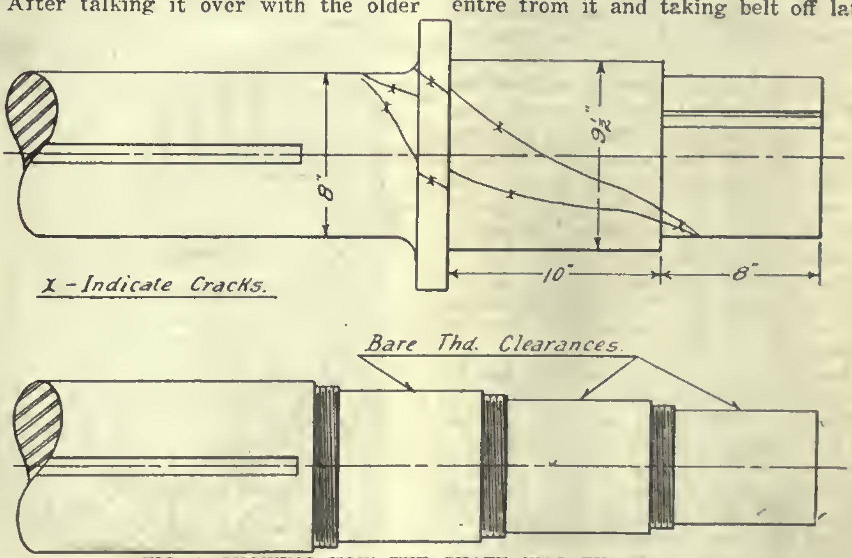


FIG. 1—SHOWING HOW THE SHAFT WAS TURNED DOWN.

this latter precaution to make sure the shaft would not be disturbed.

Meanwhile I took a piece of 12 inch hollow shaft and bored it to suit the male sizes on the other shaft and allowing 5/32 inch for internal expansion on the smallest size, then, after cutting the threads—making sure that each thread started and ended at the same point line on the jacket—all I had to do was to take it out of lathe and heat it when the other shaft was ready. The foreman examined the crankshaft very critically before letting me proceed with the work on it, but as the turning operation had taken out all the wedge crack and had left but a very minute hairline, and the material had not perceptibly changed its lines, he told me to go ahead with the job of threading; I did so, making very sure of the threads in the jacket, so as to get them all started from the same point. With the help of the smith I got the jacket heated after marking the top of it with red kiel and then we slung it in a chain sling and took it over to the shaft. After cleaning out the bore with a steel wire whisk we placed it on the shaft and the threads engaged about ¼ inch from the shoulder and we nearly tore the crane down by using the chain sling as a tongs for the jacket, and turning the shaft into it by pulling the belt which I had replaced; but the main thing to me was, that it went home and after cooling off seemed to be as one with the core.

While it was cooling I made a small plug for the hole in the end of shaft, and while the end was still hot, I placed the plug into it so that it was in to stay. I proceeded to do other work till the shaft was cold, which consisted of cutting off a piece of 16 inch hollow shaft, that I found in the scrap-pile, for a flange. I bored the piece to 10 inch dia. and threaded it with eight threads to the inch as the others were, then faced one side. Next day I carved the shaft end down to the place where the flange had to go and threaded it to suit flange, allowing 13/64 inch. for expansion, then got the smith to heat the piece to a dark red heat and after cleaning the threads we placed that also into position on the shaft, and I may say that this operation was not so easy as the first one was, mainly because neither the smith nor myself had thought about what tools we would need in case the expansion was not enough, but as it turned out it went on far enough that I was able to jam a big roughing tool into the metal on its periphery and by turning the shaft it also went all the way up. After which the rest of the job was a simple turning proposition, to make the new end exactly like the other end.

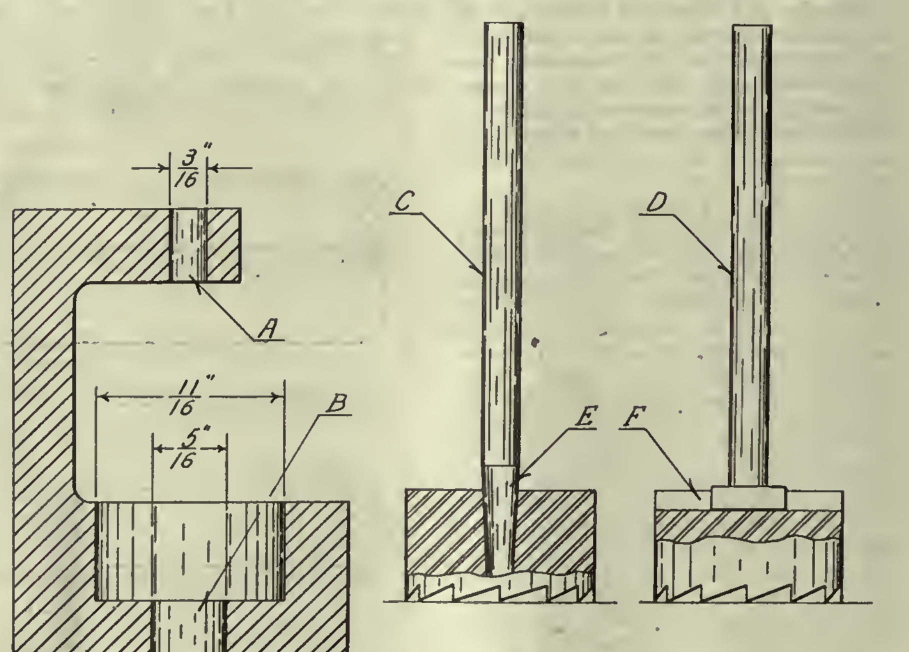
I might say at this point that the flywheel was 14 feet diam. x 3 foot rim grooved, for 12 ropes, and had a length of hub of 2 ft. 8 in. It was made in two sections, each having its own keyway and key. The sketches, as illustrated, show Fig. 1 as the shaft appeared with crack; while Fig. 2 illustrates the shaft as turned down and threaded.

What has always seemed to me, from my point of view, is the need for a machinist to be able to draw or at least to make a legible sketch, and if he can do that he can necessarily read blueprints without trouble. On the foregoing job, if I had been unable to draw, I should have had a sweet time explaining my method of procedure to either of my bosses. But as it was, they saw exactly what I tried to explain but could not put into words. Also they were convinced that the scheme was at least worth a trial.

COSTLY DESIGN OF PARTS

By J. H. Rodgers

In the design of special machinery it is not an uncommon thing to have some of the parts of such a shape that the machining of the piece calls for considerable ingenuity on the part of the mechanic who is called upon to build the machine from the drawings furnished. A case of this kind is shown in the sketch herewith. To the left is a section of a small casting that requires to have a hole drilled in as shown. It will be seen that the counter-boring of the hole in the base is no easy undertaking owing to the size of the small hole in the top lug. The drilling of the holes A and B was comparatively easy, and the method adopted for enlarging the bottom hole may be described as follows: The small end-mill cutter shown in the centre was made with a tapered hole to fit the end of the small drill rod C. The taper portion, however, was not sufficiently rigid to drive the cutter, so the method shown at the right was afterwards resorted to. The cutter was slotted across the top and the drill rod made with an enlarged end that would just pass through the 5-16 inch hole in the base. This collar was flattened on two sides to fit in the slot of the cutter, and the drive was amply strong for the purpose, with the result that the job was completed satisfactorily, and eccentricity in the holes being taken care of by the movement of the tongue in the cutter slot.

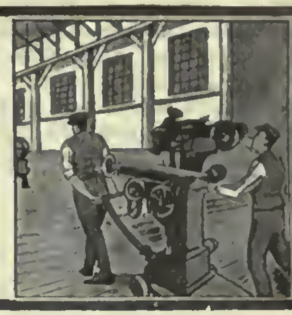


HERE IS THE IDEA IN A NUTSHELL.

The booming of the cotton and sugar industries, as well as the increase in railroad activity in Argentina, is causing an increased demand for mechanics of all kinds, says Commerce Reports. The project of the Director of Navigation and Ports to initiate a school of apprentices for the various trades is considered the first step toward general elementary trade schools in the country. Courses will embrace about 25 trades, including those of the carpenter, machinist, boiler maker, steam engineer, electrician, plumber, and radiotelegrapher. Boys who have received primary grade schooling will be apprenticed in the workshops of the Department of Public Works at Riachuelo, Santa Fe, Parana, Concepcion, and Bermejo, where four years of practical work and instruction will be received. Although the amount to be invested in this work is not large, Canadian machinery and equipment manufacturers might well aid in the starting of such schools. Certainly no better advertisement of Canadian goods could be had than their use in the training of the future mechanics of the country. (The office of the commercial attache, Buenos Aires, announces that it is in a position to forward to the proper authorities all literature or offers for school equipment, machinery, etc.)

Antimony, valued at $270,571 in 1918 and $239,116 in 1919, was the principal item shipped from Changsha, China, to the United States during those two years, when the total declared exports from that consular district amounted to $455.72 and $242,284, respectively.

DEVELOPMENTS IN SHOP EQUIPMENT



CYLINDER TEST GAUGE

The Federal Products Corporation, Providence, R. I., have placed on the market an interesting cylinder test gauge which is herein illustrated and described. This gauge detects tapered, scored or out of round cylinders, and referring to illustration we note as follows:

The gauge feelers project from casing (A). These feelers are actuated by means of a cone cam (inside the casing) which is directly connected by a steel rod running through the body (B) to a rack and spur movement that operates the dial hand. The button (C) which projects through the knurled sleeve is attached to the steel rod. By pushing down the button, the cone cam is likewise lowered, thus permitting the feelers to recede sufficiently to be inserted in the cylinder. When the feelers are inside of the bore, pressure on the button is withdrawn and the feelers are automatically released against the cylinder walls.

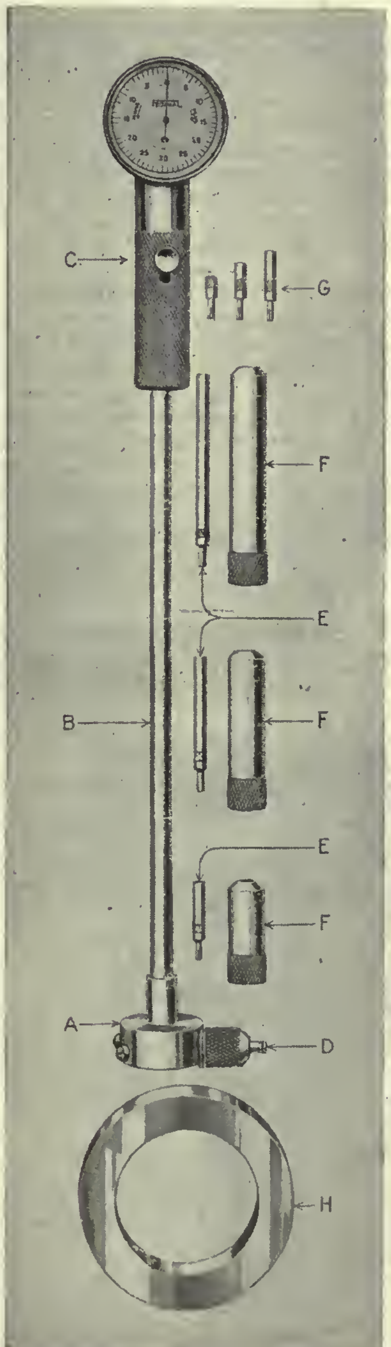
Provision has been made for building up one of the three feelers (D) so that with a set of extensions, measurements can be taken of any diameter between 2½ inches and 6½ inches. This is accomplished in the following manner: Nipples (G) are made in different sizes to cover any fractional part of an inch. These nipples fit interchangeably into the extension rods (E) which vary in length by 1-inch steps, and which are in turn supported by threading bushings (F) to match.

The gauge dial is graduated in .001 in. with sufficient space between calibrations to allow variations of .0005 in. to be easily perceptible and it always remains in plain sight, and is never buried deep in the bore so as to necessitate the manipulation of lights and mirrors to obtain a reading. It can be set to any position with reference to the hand by turning the knurled bezel. The function of the master (H) is to furnish a means for setting the gauge accurately to a standard diameter. We can furnish masters of the type illustrated, to any diameter specified.

Where the gauge is to be used to measure the variations from one standard diameter as is the case with motor manufacturers and many service stations, extensions (G), (E) and (F) will ordinarily not be required. In such instances, the feeler D is made solid.

Method of Operation

In practice the feelers before insertion in the cylinder are set to a master (as illustrated by cut H), while at the same time the face of the dial is turned until the hand is coincident with the zero. The feelers are then introduced into the cylinder bore and applied to any part of the cylinder wall desired.



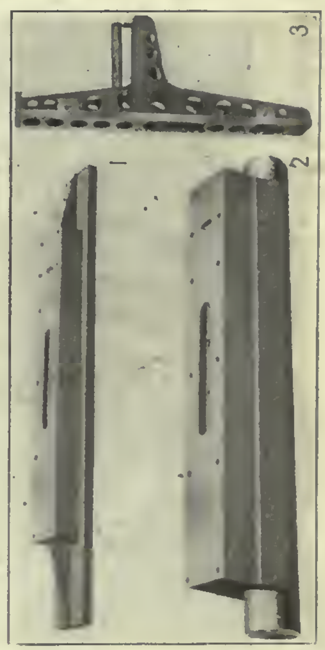
DETAILS OF GAUGE

The instrument is rocked from side to side, in a fashion similar to that employed with inside micrometers. The position of the hand at the high point records the plus or minus variation from the standard diameter.

The feelers always bear with uniform pressure on the sides of the cylinder walls, so that readings are in no way dependent on the human touch and are thus accurate and positive. An added advantage is also derived from the fact that the gauge can be applied regardless of the position of the cylinder block.

LEVELLING INSTRUMENTS

The Ricker Instrument Co., 1919-21 Fairmont Ave., Philadelphia, have placed on the market a line of precision levels for machine shop use. At Fig. 1 on top of cut is shown a machinists' level, while Fig. 2 (at bottom) is an instrument designed for use in levelling shafting. Fig. 3 is a plumb level used for plumbing planer uprights and other



THE THREE STYLES OF INSTRUMENTS

vertical surfaces. The vials of these levels are ground and graduated, and it is claimed that the bubbles will be deflected 0.10 inch for every 0.001 inch. The work is out of level in one foot. To further ensure accuracy the cases are put through a heat-treating process to prevent warping.

DOUBLE SPINDLE DISC GRINDER

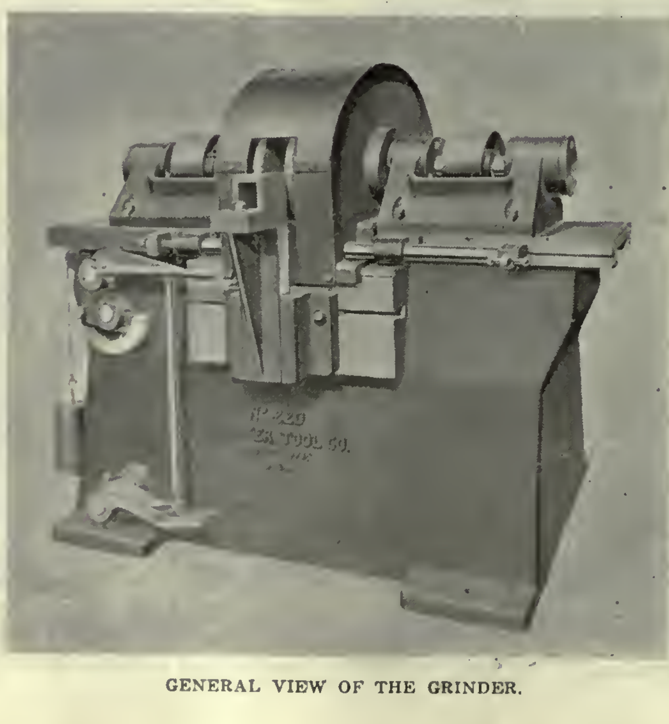
The Badger Tool Co., Beloit, Wis., have recently put on the market their new double spindle type disc grinder, known as their No. 220 type. This machine is of unusual rigidity and weight, and is intended for finishing the two opposite parallel faces of work within its scope, such as drop forged wrenches piston rings, nuts, etc.

Abrasive cylinders held in chucks are interchangeable with the disc wheels, making it possible with extra equipment which they furnish to use water or grinding compound.

This particular grinder is designed to carry two 20-inch disc wheels or two 16-inch abrasive cylinders. The 2-3/16-inch. diameter spindles are mounted in both radial and thrust ball bearings. The spindle pulleys are 8½-inch diameter by 6-inch face. The ways on base are 10-inches wide by 20 inches long; bottom of sliding head, 10 inches wide by 26 inches long.

The machine incorporates numerous features, the most prominent of which are the provision for excluding all dust and grit from the sliding ways; the positive micrometer stop screw, and the rigid construction of work supports.

The machine is made in both belt and direct motor drive, and the height of spindle from floor is 38 inches and the extreme overall length 70 inches. The entire equipment weighs 4,700 pounds.



GENERAL VIEW OF THE GRINDER.

NEW THINGS IN MACHINE TOOLS

The Sebastian Lathe Company, of Cincinnati, has designed a new type of 13 and 15 inch lathe with a semi-closed headstock. These machines are also furnished with a gap if desired.

PORTABLE JOINER

A small portable bench joiner has recently been brought out by J. D. Wallace & Co. of Chicago. The power required for operation is a ½ h.p. motor, which is fitted direct to the frame of the machine. The joiner is so designed that it may be operated from a lighting circuit.

INDICATOR HOLDER

A device for the holding of indicators when used on large square with blade of from 2 to 3 inches in width, has recently been brought out by Guldager and Jantch Co., of Detroit. Easy adjustment is obtained by the use of small balls that have contact on the edge of the square blade. The slide is locked in position by means of a thumbscrew at the back. The indicator is not included with the holder.

ELECTRIC AIR COMPRESSOR

A new departure in the way of air compressors has been made by the Black and Decker Manufacturing Company of Baltimore, Md. The machine is electrically driven and made in two types, high and low pressure. Both types are identical with the exception of the bores, the high pressure machine having a bore of 2¾ inches and the low pressure machine having a bore of 3¾ inches. The larger machine will work up to a pressure of 200 pounds per square inch.

SHARPENING MACHINE

The Ingersoll-Rand Company, of New York, has recently developed a compressed air operated drill steel sharpening machine. This machine has been designed to sharpen the points and form the shanks of drill rod of different shapes and up to 2 inches in diameter. This machine can be fitted with special attachments for the forging of bolt-heads, pins, etc. One control lever is sufficient for all the operations of the machine, and this lever is provided with a safety locking device. The throttle is of the balanced spool type, operates easily and quickly, is positive and instantaneous in action.

NEW BENCH LATHE

The Package Machine Company, of Springfield, Mass., has recently placed on the market a new precision bench lathe that has several interesting features of design. The headstock is fitted with ball thrust bearings, a split nut clamp in the tailstock, and adjustable nuts in the compound rest feed screws. The large pulley on the countershaft is of aluminum for minimizing inertia. The bed has a length of 36 inches, with 16 inches between centres. Swing over the bed 8 inches. Six changes of spindle speed are provided ranging from 350 to 1,200 h.p.m. Bench space 6 x 39 inches.

ROTARY SHEAR

An interesting and serviceable type of rotary shear for sheet metal work, has been placed on the market by the Southwark Foundry and Machine Company of Philadelphia. The upper cutter is carried in a turret that can be revolved about its own axis and likewise the lower cutter, so that circular, oval, or odd-shaped holes may be cut out of a sheet without slitting in from the side. Control of the machine is obtained by means of a foot treadle operating a sensitive clutch, and the cutter can be stopped or started within 1-32 inch of the feed. The machine is built in five sizes for gauges from No. 18 upwards. The throat depths range from 18 to 36 inches.

HAND MILLER

The Superior Machine and Engineering Company of Detroit are now manufacturing a hand milling machine that has been especially designed for accurate work, being rigidly constructed and easily handled. Both spindle head and knee are adjustable, being fitted to flat guiding ways on the column. The spindle runs in bronze bearings that are adjustable for wear. The machine has been designed to be driven direct from the main shaft, or, if desired, the machine may be supplied with a 1½ h.p. motor that can be secured to the base of the mamachine. The spindle has twelve changes of speed ranging from 150 to 600 r.p.m. Table surface is 22 by 4¼ inches. The floor space is 34 by 41 inches, and the net weight is about 860 pounds.

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PRINCIPAL CONTENTS

The Outlaw Strike

SOME months ago an outlaw strike of switchmen was started in the United States. At first the only persons affected were the switchmen themselves.

It was not long before others were touched. It was a comparatively short time before hundreds, then thousands of workers were thrown out of employment because traffic had ceased to move on account of the first strike.

The others who were thrown out of work had no quarrel with the people for whom they were working. They probably had working arrangements that were quite satisfactory.

They were forced into idleness because a set of outlaws broke out and tied up traffic.

The loss of wages and the decreased purchasing power as a result are so large by now as to be past analyzing. And this loss is going to go on for some time to come, as it will take weeks to straighten out the mess that has been left as a monument to the selfishness of the outlaw strikers.

There is a dependence between men that cannot be successfully shoved to one side.

When one set of hot-heads get the idea that they can live unto themselves, or arrive at the stage of mental callous where the sufferings and inconvenience are of supreme indifference to them, they are putting so much grease on the skids that the slides are dangerous and often disastrous.

And when things start to slide it is no easy matter to reach around and find a man big enough and powerful enough to put a peg in.

Decent labor organization has got to take a hand in this thing. If it does not want to get tied up in reputation with the lawless element, it must get busy and hit the thing on the head.

An attitude that amounts to no more than an official slap-on-the-wrist for the rebels is as truly wasted as trying to put Vesuvius out with a tea kettle.

The New Tariff

TRIBUTE is paid to the essential character of the lines dealt in by the machine tool trade, and by the steel and iron business in general, in that in no instance will they be called upon to pay the luxury tax. We are not referring to some of the products manufactured by these tools and material, but to the materials and equipment themselves.

The new tariff regulations make it clear that the Government considers that many people are troubled with the habit of dollars burning holes in their pockets. Hence the way to save the pockets is to rid them of the dollars.

Inasmuch as the new taxes aim at curbing extravagance and buying beyond the limit of what they are able to pay for, they will serve a good purpose. Money has been coming easily of late, and it has been going in the same manner.

When the war was on no sacrifice was too great for people to make in order that the men at the front should be backed to the limit of our ability. We took on great big national obligations then, and we have got to discharge them now, and the money has to come from the people.

The method of taxation now, which is more direct than anything we have been used to, will bring home to many people for the first time the realization that taxes and levies are real, and that in their own attitude lies the ability to increase or decrease them.

Speaking of Brave Men

WHEN this here season rolls around between the spring and summer, when one day's wet and dreary, the next a six-foot hummer—'tis then I like to watch the crowds and see the changing style, they cause a chuckle for to come and stop with me a while.

'Tis then I see one miss go by, with fur wrapped round her neck—another one stripped off, by gum, as passin' through a wreck.

Some men have coats wrapped 'round their chest to cover up their hide, while others go a-sailin' past, their vests and jackets wide.

Here comes a chap with old felt hat, its vintage we can't trace—it rests upon his ears, it does, and sprawls upon his face. It is a mean and tacky thing, it has not style nor class; in fact, my boy, it soundeth like a shapeless, time-worn mass.

But here there comes the man I love, the folks turn round to squint—he savors of the new mown hay and hunks of savory mint. There beameth from his jaw a grin, another loops his ear, he's walkin' 'round, by gum, he is, to radiate good cheer.

And on his dome there sitteth now a brand new hat of straw—it is a new and nifty thing, and built without a flaw. He cares not for the chap who stops and stares to beat the band, at the man who's brave enough to wear the first straw in the land.

So let us toast this first straw hat, and sing to it a verse, it took five plunks, by heck it did, from out his skinny purse. He is a brave and fearless soul, he is a valiant kid, the man who leadeth from the store the first new straw-made lid.—Ark.

The average man is dead anxious to see prices drop until it comes his turn to put his pay envelope on the skids and see it slide. Of course, the ideal condition would be to take deflation out of everything except wages. It generally works out, though, that prices and pay cheques get on the toboggan together.

In Kingston, a Mr. Sudds has lost a schooner at one of the city docks. All of which will cause some of the thirsty ones to heave a sigh and ponder on other schooners and suds that lived in the golden age.

MARKET DEVELOPMENTS

Traffic Conditions Showing No Improvement

And Material Is Being Piled at the Mills—Canners Facing the Season With Much Needed Materials Not Moving—Trade Not Much Bothered Over the New Tariff Regulations

THE way in which traffic has been held up from United States points for weeks past may mean that some Canadian buyers will save the war tax on shipments of material, such as various lines of steel and machinery. Dealers will be only too ready to pass on anything that looks like a measure of relief to the trade, but there is a certain amount of stock in the warehouses, and on this there will be no reduction. There is such a scarcity of material now that 7½ per cent. does not make much difference, when compared to the big problem of getting the shipments through at any price.

Pittsburgh reports that steel is becoming more and more congested, and promises nothing better. Canners are facing a serious time of the year, with the preserving season not far off and their supply of tin plate not moving. It is estimated that right now it would require 3,500 box cars to move the tin plate necessary for the canning season, and the movement has not started yet.

Inquiries are not particularly numerous just now. Large projects in several instances are held up, waiting to see if there will be any decreases in the building prices, as the price of plants for housing new equipment is a serious problem.

Most of the larger buyers of iron and steel scrap are out of the market for the present, and their continued absence is having the effect of making trade dull. Little exporting business is being done in either copper, brass or steel scrap.

MONTREAL BUYERS CONSERVATIVE UNTIL NEW CONDITIONS ARE CERTAIN

Special to CANADIAN MACHINERY.

MONTREAL, May 27.—The handing down of the budget and the possible effect that the various taxes will have on business and industrial activity is one of the chief topics of interest at the present time. It is a little early yet to make any reliable prediction as to how the new regulations will affect the different branches of the metal-working industries, but between the uncertainty of this and the apparent wave of price deflation that has become increasingly pronounced during the past week, particularly in the States, the attitude of many business men and manufacturers is one of marked conservatism. The present movement may only be a temporary relaxation from the erstwhile strain of the high cost of living, and a general stabilization may return in a very short time, but the firm stand of the banks on the credit question has tended to reduce the speculative character of business transactions, so that hope is entertained that some adjustment may shortly be made whereby the factor of doubt will be largely removed and a more orderly condition established.

The condition of the wire market may be stated as acute as the scarcity of supply is apparent in a marked degree. Dealers in wire goods claim that it is very difficult to obtain material and virtually impossible to secure sufficient to satisfy the normal requirements of present demand. One manufacturer here stated that he could obtain orders for hundreds of miles of fencing but owing to the inability of get the wire he had to forego the business.

The wire situation has not only resulted in the curtailment in the making of wire products, but in some cases these manufacturers have engaged in other activities to tide them over until normal conditions return in the wire market. Some dealers in steel commodities are anticipating better shipments in the near future as local shortage is due more to the inability of the railroads to transport than any actual shortage of material. American mills have been producing more than could be taken away, the result being that stocks have accumulated at the mills or stored in nearby warehouses, but with little hope of relief until railroads are in a better position to handle the goods. Local consumers of plates and sheets are getting anxious as to early future supply, but are interested in the apparent tendency toward easier conditions, not only in supply but likewise in prices.

Railroad Congestion Affects Trade

While the trading in machine tools is comparatively good, the bulk of present business must be credited to resale of used equipment. The demand in this direction emphasizes the user's need for tools, and it is only the high prices of new machinery and the uncertainty of delivery that keeps the sales of new tools down. The congested railroad condition in the States is the prime reason of deferred shipments as it is very difficult to get the raw material to the plants and equally difficult to have the finished product delivered to the customer. Rail transportation just now is so uncertain that shipments by steamship have an advantage, and as a consequence a good business is carried on between English houses and Canadian consumers.

Dullness in Scrap

No features of special interest have developed in the old material situation and the market here is rather listless, with prices tending to decline. Conditions in the States are not favorable to ship to American points and Canadian mills are not heavy buyers. The foundry troubles here have lessened the demand for machinery scrap, with the result that the buying has declined, but while the general market is less active dealers are holding to old prices. The tendency, however, is of a downward nature.

The Blashill Wire Maachinery Company of Montreal, has opened an uptown office and show room at 307 St. James Street, and will carry on, in addition to their present line cf wire machinery, a general dealer business in new and used machinery and engineering equipment. The plant at 182 Shearer Street will be utilized for the repairing and rebuilding of used machinery.

The Standard Equipment and Tool Works of Montreal, have removed their offices from 179 St. James Street to 307 St. James Street, where they will have an office on the ground floor, and will share the adjoining showroom with the Blashill Wire Machinery Co.

NOTHING IN THE LUXURY LINE HERE

But Trade Has Hardly Had Time to See How New Regulations Will Work Out

TORONTO.—The trade has not had time to see how the new tariff arrangements work out in detail, although it is not a very hard matter to apply the new ruling to any branch of the trade. There is practically nothing, to begin with, that is touched by what may be termed the luxury tax, and the biggest item, of course, will be the elimination of the war tax of seven and a half per cent.

Customers will get the benefit of this at once on any machinery they are getting from the makers, and the recent traffic tie-up in the U.S. may be the means of some buyers getting a saving of at least six and a half that they were not looking for, which, on an expensive bit of equipment, will run into quite a nice little saving.

There is a feeling in the machine tool trade that there must be an end to price increases. Manufacturers know that there is a limit past which they dare not go in making investments that have to be accounted for in years to come on the yearly turnover.

There are no very large propositions definitely in the market at the moment, although some are hung up in the meantime waiting for a turn in the tide of rising prices. In some cases it is urgently necessary to go ahead with the building and the placing of equipment but the price is an obstacle that is too high. Building charges are far more extreme than the increase in equipment, and it is too great a handicap to put up an expensive house for machinery at the present schedule; Firms that are making additions to existing equipment, for which they already have floor space, are still in the market in fairly good numbers, and deliveries to them are improving.

Machine tools coming into Canada from United States are, in most cases, under the general tariff of 27½ per cent. Of course there are several exceptions, especially where the machine is not to be had in this country. But tariff item No. 453 will cover the great bulk of imports in this line. It reads:

"Telephone and telegraph instruments, electric and galvanic batteries, electric motors, dynamos, generators, sockets, insulators of all kinds, electric apparatus, n.o.p.; and all machinery composed wholly or in part of iron or steel, n.o.p.; and iron or steel castings, and iron or steel integral parts of all machinery specified in this item, British preferential tariff, 15 per cent., intermediate tariff, 25 per cent., and general tariff, 27½ per cent."

United States products come in under the general tariff, viz., 27½ per cent., while the British machine tool houses can ship in at 15 per cent., or a difference of 12½ per cent.

The Steel Market

The manner in which a large tonnage of steel of all sorts has been strung up by the poor shipping facilities on the other side of the line will mean some saved money to customers on this side of the line, but whether it will make up for the trouble they have been put to in waiting for the shipments to arrive is rather doubtful.

Material used in manufacturing boilers, for instance, now comes in free. One item covers a lot. "Wrought or seamless iron or steel tubes for boilers, n.o.p., under regulations prescribed by the Minister of Customs; flues and corrugated tubes for marine boilers, free."

Then boiler plate comes under the following regulation: "Item 380: Boiler plate of iron or steel, not less than thirty inches in width, and not less than one-quarter of an inch in thickness, for use exclusively in the manufacture of boilers under regulations by the Minister of Customs, free."

A great deal of the tonnage coming through the jobbers is taken in under this item: "Rolled iron or steel sheets or plates, sheared or unsheared, and skelp iron or steel, sheared or rolled in grooves, n.o.p., British preferential tariff, per ton, $4.25; intermediate, $6, and general tariff, $7."

Some of the larger importers report that service in the matter of delivery is not improving. If such a thing could be possible they would be inclined to state thta conditions in this regard are worse than ever. Some buyers have received their first tonnage in weeks, whilst others have almost given up hopes of ever hearing of their consignments.

The Scrap Market Dull

Most of the larger buyers are still out of the market, and as a result all classes are sagging. As in other lines the buyer is paying the one per cent. tax on sales. It is simply added to his bill. As a general thing there is not much scrap brought into this country except by some of the larger melters, who find it convenient to make contracts outside. The tariff item covering such a case is No. 374: "Iron or steel scrap, wrought, being waste or refuse, including punchings, cuttings or clippings of iron or steel plates or sheets, having been in actual use; crop ends of tin plate bars, or of blooms, or of rails, the same not having been in actual use, per ton, British preferential, 50c; intermediate tariff, 90c, general, $1." The regulations go on to state further in explanation that nothing shall be deemed scrap iron or cast steel except waste or refuse iron or steel fit only to be remanufactured in rolling mills or furnaces: provided that articles of iron or steel, damaged in tranasit, if broken up under customs supervision and rendered unsaleable except as scrap may be entered for duty as scrap. Scrap copper and brass are free of duty.

POINTS IN WEEK'S MARKETING NOTES

Pittsburgh reports that shipping conditions are even worse than a week ago, but hopes are held out for something better following the action of the Interstate Commerce Commission.

Canning season is coming on, and makers of tin cans are in poor shape owing to the shortage of tin plate.

The tax of one per cent. is being passed on to the consumer.

Some firms are likely to make a saving because shipments of material, such as steel, tubes, sheets, etc., have been held up. Meanwhile the 7½ per cent. war tax has been removed.

It would require 3,500 box cars to move the tin plate now stored for the canners.

Some critics are predicting that the first decline in steel will be when the premium operators get down to Industrial Board prices.

The big buyers are still out of the market for scrap iron or steel, and as a result business is dull, with prices inclined to sag.

Strike Against Prices.—The 16,000 employees of the Cambria Steel Company, a subsidiary of the Midvale Steel Company, are on strike against the high prices which the merchants have been charging, and are threatening to form a co-operative store which shall deal in all of the necessities demanded by a worker and his family. The workmen are willing enough to give their trade to the merchants, but only on condition that prices are reduced. The announcement of the new policy of the workmen is made by the committee which represents the workers in dealing with the Midvale employees.

TRAFFIC CONDITIONS CONTINUE TO GET WORSE AND STEEL SHIPMENTS LAG

Special to CANADIAN MACHINERY.

PITTSBURG, May 27.—At the time the last report was written traffic conditions, growing out of the rail strike, were becoming worse rather than better, and the trend has continued in the same direction. Meanwhile, however, the Interstate Commerce Commission has begun to exercise the powers given it by the Transportation Act of last February, and strong hopes are entertained that conditions will now improve. The commission was urged to act by leading railroad officials. The orders of the commission, which are being issued from day to day as the way is made clear, include many things, such as abrogation of car service rules, disregard of original routings of shipments, establishment of priorties for various commodities and direct routing of trainloads of empty cars to points where cars are particularly needed.

It must be understood that the object of these activities is not primarily to relieve the congestion as a whole, but to facilitate the movement of the most important commodities, foodstuffs coming first and then coal. Iron and steel products in general cannot of course be regarded as entitled to any priority, except in special instances, and one noteworthy case is that of tin plate. The canning season is just beginning, and if tin plate is not moved to can factories, and cans to canneries, food will be lost. The Interstate Commerce Commission has gone carefully into the tin plate situation, having had leading representatives of the industries of tin plate making, can making and canning with it in conference last week. The tin plate manufacturers reported that about 2,500,000 boxes of tin plate lay in the warehouses of the tin plate mills, which would be enough to make one billion two-pound cans (a rule easy to remember is that approximately 2½ boxes of tin plate make 1,000 two-pound cans), for the movement of which 3,500 or 3,600 box cars would be required. The commission would not undertake to interrupt the movement of box cars West, for moving grain, but efforts are being made to find the box cars by other means.

The real strike itself is still on, though it has waned somewhat. There is divergence of opinion as to haw much of the trouble is due directly to there not being enough men to work on the railroads, and how much is due to the congestion that has been produced by the strike, which is now about eight weeks old. Practically, the point at issue would be whether the termination of the strike itself would right matters, for if the present trouble is due chiefly to congestion ending the strike would not end the congestion. There were traffic difficulties and car shortages in the first three months of the year, before the strike. The better opinion seems to be that the strike really is an important factor at this time, so that its entire settlement would help very materially. It is accepted in most quarters, apart from this, that the present work, directed by the Interstate Commerce Commission, will tend to relieve the congestion very considerably, even though the immediate object is better movement of foodstuffs and fuel in particular.

Accumulation of Steel.

A rough estimate of the quantity of steel that has accumulated at steel mills may be made in thismanner. One starts with the March production, which was at the rate of 45,200,000 gross tons of steel ingots a year, as indicated by the monthly report of the American Iron and Steel Institute. The March rate had been the highest since October, 1918. Finished rolled steel products run normally about 76 per cent. of the ingot production (on account of scrap and scale losses in rolling and heating) and applying this proportiono and passing from the gross to the net ton the March rate of production appears to have been about 750,000 net tons of finished rolled steel per week. Thus far the computation is substantially accurate. Now one may make a careful guess, rather than a precise estimate, that production since April 1, when the strike began, has been at 80 per cent. of the March rate, averaging the whole country, and that shipments have been 65 per cent. of the production, whereby shipments would be 52 per cent. of the March production, and the accumulation would be 28 per cent of the March production, 28 per cent. of 750,000 tons being 210,000 tons. For eight weeks this would be 1,680,000 net tons. There were some accumulations before the strike started, due to the previous car shortage, though those accumulations were diminishing late in March. Then there is a large tonnage of steel that has been "shipped" but is simply stalled en route. The grand total of steel made but not received by consumers and not actually moving as it should, is probably in excess of 2,000,000 tons. All the steel made, of course, has been on order, and none of it is for sale. The market is stagnant at present, and if one desires to forecast what sort of a steel market there will be when the traffic situation is righted he should take into his reckoning this extra 2,000,000 tons of steel, which eventually wil reach the buyers.

All branches of the iron and steel market are stagnant, and while producers are disposed to argue that the quietness is due to the rail case it is difficult to put all the responsibility on that head. If a quiet market is a natural result of consumers not receiving deliveries the active and advancing market of early in the year has to be explained. At that time consumers were doubling up in their purchases. When they received poor deliveries against old contracts they bought afresh, at premiums, for early deliveries. Again, if the present quietness is due to buyers not receiving deliveries, will the buyers become eager to make fresh purchases by the resumption of heavy deliveries?

It is a reasonable inference that buyers of pig iron and steel products are influenced by the unsettlement in Wall Street and by the general talk that commodity prices in general are coming down. Probably in many quarters too much is expected in the matter of price declines, but it does look as though some movement has begun. As to steel products, a disappearance of the premiums over the Steel Corporation or Industrial Board prices does not seem too much to expect, in the course of a few months. It is quite improbable that the market would go beyond that. Whatever readjustment is needed in the economic situation there does not seem to be any basis for predicting that the adjustment will require a long time.

As to pig iron, it must be remembered that it is too high relatively to finished steel products. The prices are not in line with each other, hence pig iron may easily come down more than finished steel, but there is hardly likely to be any slump. While pig iron in all markets is now well above $40, furnace, except in the case of Birmingham, it must be remembered that no very great tonnages were sold at about $35, and a decline to that level would not make a great deal of difference.

BUYERS STAYING OUT OF NEW YORK MARKET

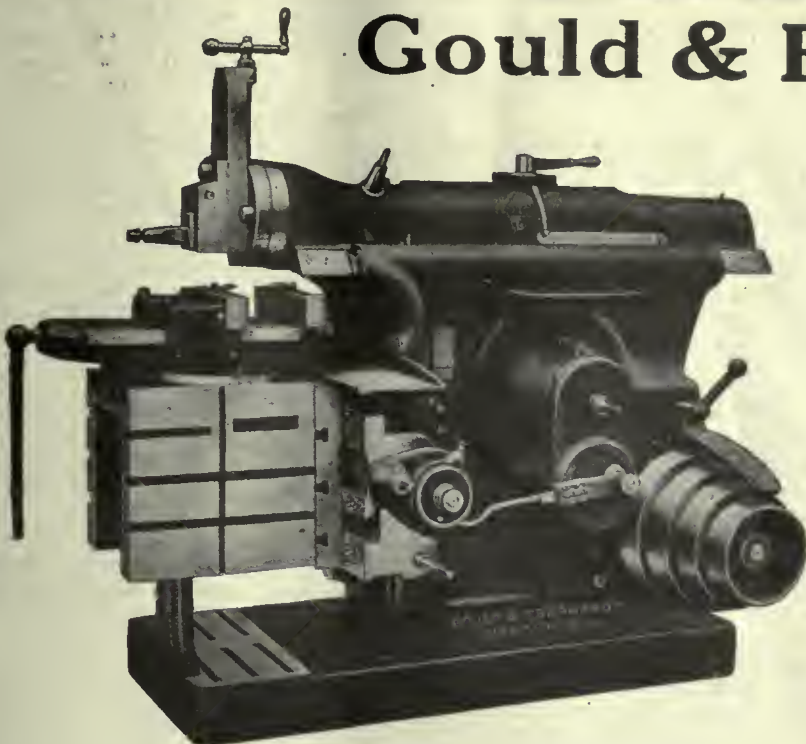
Credits, But Tool Builders Have Plenty of Orders

Special to CANADIAN MACHINERY.

NEW YORK, May 27.—The slump in machine-tool business, which made itself felt two or three weeks ago, coincident with the pinch of the credit situation, due largely to the railroad tie-up, has progressed to a point of marked inactivity. Machine-tool sellers assert that many of their customers are willing to buy, but see no use in doing so until the present credit strain and the difficulties of railroad transportation have been overcome.

That the machine-tool trade does not fear any permanent ill-effects from a business depression was indicated by A. E. Newton, of Worcester, Mass., president of the National Machine Tool Builders' Association, before the spring meeting of that body at Atlantic City last week. Mr. Newton stated that if the country is to have a business depression it cannot be of long duration. He admitted a falling off in new orders, but said that nearly all machine-tool builders have a large volume of unfilled orders. He said he looked forward to a resumption of good business in a few months. Meanwhile, he does not look for any change from the present level of prices because of the shortage and high price of labor and materials.

Most of the sellers of machine tools



Gould & Eberhardt High-duty SHAPERS

16" - 20" - 24" and 28" sizes

Ask for Catalog and details describing the exclusive features.

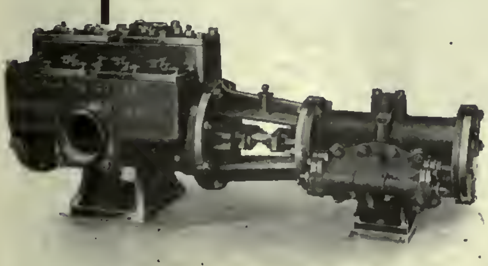
We can give early delivery.

The A. R. Williams Machinery Company Limited

Halifax, St. John, Montreal
Winnipeg, Vancouver

If it's Machinery—Write "Williams"

64 Front St. West
TORONTO



We Have the Pump You Need

EXCLUSIVE manufacturers of the well known and reliable TOD and MARTIN Pumps.

We are ready to supply you promptly with Simplex and Duplex Boiler Feed Pumps and Vacuum Pumps for High and Low Pressures. **Competent advice gladly given.**

Several sizes in stock.

John T. Hepburn, Ltd.

18-60 Van Horne St.,
Toronto, Ontario, Canada

When you buy Files, you buy Cutting Service.

When you buy P.H. or Imperial Files you buy the Best Cutting Service.

"They cut faster and wear longer."

Be File-Wise.

Ingersoll File Company, Limited,
Jno. Morrow Screw and Nut Co., Ltd.,
Sole Distributors,
Ingersoll, Ontario.

in this country have protected themselves against possible cancellations by inserting non-cancellation clauses in their bills of sale. Such clauses may not absolutely prohibit cancellations but they will provide penalties in cases of cancellations that will protect the manufacturers and dealers against loss in the event of declining prices.

Buying of machine tools in the past week has been confined mostly to a few large companies, which are completing purchases begun some time ago. For example, the Willys Corporation has covered on a large number of tools required to round out the equipping of its new automobile plant at Elizabeth, N.J., and the General Electric Co. continues to buy for its Bridgeport, Conn., plant, otherwise the market has been exceedingly quiet.

Montreal Notes

The immediate result of the release of ocean tonnage from the control of the British Ministry of Shipping, which has just been effected, is the increased cargo space that is available for Canadian exporters, and port officials here are anticipating this will give added impetus to the season's business. The final report of the British Ministry of Shipping shows that, under their control, the total expenditure was in the neighborhood of $2,300,000,000; the total deficit being approximately $925,000,000.

The Montreal Administrative Commission have given out the contracts for the additional equipment that will be installed at the low level pumping station of the city waterworks. Two 30,000,000 gallon electrical-driven pumps will be installed; one of these will be supplied by the Fraser Chalmers Company at a cost of $50,250, and the other will be built by E. Laurie and Co., the price for this unit being $45,200. The installation of the electrical transformers, etc., will be carried out by the Canadian General Electric Company at a cost of $48,840.

* * *

Clarence I. de Sola, Belgian consul at Montreal since 1904, and a prominent business man in financial and shipping circles, died last week at Boston after an acute attack of indigestion. He was sixty-one years of age. For many years Mr. de Sola was president of the Canadian Zionists, a society which was started through his own personal efforts. In recognition of his services during the war he was knighted by King Albert of Belgium and created a Chevalier of the Order of Leopold. In business life he was largely interested in shipbuilding, bridge construction and hydraulic lift-locks. He was Canadian representative for Swan, Hunter and Wigham-Richardson, Limited, and he built a great number of ships for the Canadian upper lakes and ocean trade, introducing the first two oil fuel combustion ships that ever crossed the Atlantic, the Toiler and the Calgary. As managing-director of the Comptoir Belgo-Canadian, he carried out some noteworthy works in Canada, among which were some of the locks in the Soulanges and Trent canals, thus introducing in Canada the hydraulic lift-lock. He also took part in the retracking of a portion of the Intercolonial Railway and the Prince Edward Railway Company. He established a steamship service between Montreal and Antwerp. He was on the directory boards of many of the local shipping companies.

* * *

Extensions to the extent of about a quarter of a million square feet of floor space has been planned for the Angus shops of the Canadian Pacific at Montreal The cost of these additions is expected to approximate $1,000,000. The division of these extensions may be roughly stated as follows: Locomotive shop, 58,000 sq. ft.; freight car shop, 42,400 sq. ft.; pattern storage, 12,000 sq. ft.; passenger car shops, 71,000 sq. ft.; car electrical shop, 23,000 sq. ft.; planing mill shelter, 18,000 sq. ft.; dry kiln, 7,400 sq. ft. In addition to the new buildings a new heavy service tapered floor track scale will be installed at the west end and sufficiently large to weigh locomotives. A number of track changes will also be made at both ends of the yard to provide extra car capacity. Provision is also made for the installation of a 50-ton mechanical coaling plant.

FOOD PRODUCTS ARE LIKELY TO STAY HIGH ?

New York Financial House Can See No Reason For Hoping For Lower Values Yet

IN THEIR weekly business letter, Hayden, Stone & Co., investment brokers, New York, have the following to say regarding general conditions:—

Whether due to a change in the psychological atmosphere, owing to reports of cancellations and to reductions in price by large merchandise retailers, or to badly crippled transportation facilities or to both, it has now become quite evident that there is a distinct recession in many lines of business. While such an interruption to progress of business as has been occasioned by the outlaw railroad strike is most regrettable, it has also furnished a greatly needed object lesson, which could, perhaps, be supplied in no other way—that no body of men employed in such a vital industry can quit work without seriously affecting great numbers of other wage-earners. The men who, without cause, went on strike, are to-day very justly most unpopular with men who have thereby been wholly or partly thrown out of jobs. The loss of wages, and, therefore, of purchasing power which this has caused, are beyond computation. The fact is that the transportation system of this country is at the best so inadequate, and has been still further so crippled by the action of these men, that even were all other conditions favorable, this alone would make it impossible to continue business operations at anything like the volume necessary to show the best results. Nor is this a condition that, even if the roads generally could command the necessary capital, could be remedied in a week or a month. It would take years to supply the equipment to put the railroads on a basis where they could adequately serve the business of the country.

The point has been well made that there has never been an instance of any serious financial depression when there has been such a general scarcity of goods, but the difficulty in securing goods, owing largely to transportation conditions, is apt to blind one to the fact that productive capacity is probably well up, and, perhaps, in some lines exceeds consumption. The productive capacity of steel in this country to-day must be fully 50,000,000 tons. This is much greater than has been actually consumed in any one year. It seems doubtful if this great capacity could at the moment be profitably employed—certainly not at prices now ruling. The same is true of articles entering into clothing and manufactures generally. Unfortunately, it is not true of food products. The movement of labor away from the farms has become alarming. This will in time be corrected by the lessening of pressure for labor in manufacturing industries, but this will take time, and, meantime, food products are bound to remain high.

The one outstanding and controlling factor to-day—not only in this country but throughout the world—is the shortage of capital. This is due to three causes: the destruction of capital in the war; the tremendous expansion of industry as evidenced by the great outpouring of securities in the last few years, and, finally, by the absorption in taxes of profits that would otherwise be available for enlarging business facilities. The fact is being brought home that there is a vast difference between currency and capital; that inflating currency does not increase the supply of loanable capital. It seems to us that this shortage of capital, which, after all, is but a synonym for accumulated wages or savings, is bound to result in continued high rates, which of itself is a restrictive and deflating influence. This process of deflation through which we are now passing is disagreeable, but vastly to be preferred to the experience which Japan, for instance, has recently undergone. It will in time bring about its own cure, and, meanwhile, will present opportunities to those in position to take advantage of them.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$42 40
Lake Superior, charcoal, Chicago	57 00
Standard low phos., Philadelphia	50 00
Bessemer, Pittsburgh	43 00
Basic, Valley furnace	42 90
Toronto price:—	
Silicon, 2.25% to 2.75%	52 00
No. 2 Foundry, 1.75 to 2.25%	50 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 50
Steel bars, base, Toronto	5 50
Iron bars, base, Montreal	5 50
Steel bars, base, Montreal	5 50
Reinforcing bars, base	5 00
Steel hoops	7 00
Norway iron	11 00
Tire steel	5 75
Spring steel	10 00
Band steel, No. 10 gauge and 3-16 in. base	6 00
Chequered floor plate, 3-16 in.	9 40
Chequered floor plate, ¼ in.	9 00
Staybolt iron	9 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	4 00
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 90
Small shapes under 3"	3 62

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points	C.L.	L.C.L.
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

	Gross. Montreal	Toronto
Lake copper	$25 00	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	72 00	75 00
Spelter	12 00	12 25
Lead	11 50	12 00
Antimony	14 50	14 00
Aluminum	34 00	35 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 7 25	$ 7 25
Plates, ¼ up	6 50	6 50

PIPE—WROUGHT

Price List No. 44—April, 1920.

STANDARD BUTTWELD S/C

	Steel Black	Steel Galv.	Gen. Wrot. Iron Black	Gen. Wrot. Iron Galv.
⅛ in.	$5 50	$ 8 50	....	....
¼ in.	5 13	7 26	$ 5 43	$ 7 56
⅜ in.	5 13	7 26	5 43	7 56
½ in.	6 84	8 42	7 27	8 84
¾ in.	8 45	10 58	9 03	11 16
1 in.	12 50	15 64	13 35	16 49
1¼ in.	16 91	21 16	18 06	22 31
1½ in.	20 21	25 30	21 59	26 68
2 in.	27 20	34 04	29 05	35 89
2½ in.	43 00	53 82	....	....
3 in.	56 23	70 38	....	....
3½ in.	71 30	88 32	....	....
4 in.	84 48	104 64	....	....

STANDARD LAPWELD S/C

	Steel Black	Steel Galv.	Gen. Wrot. Iron Black	Gen. Wrot. Iron Galv.
2 in.	$30 90	$37 74	$34 60	$41 44
2½ in.	45 34	56 16	51 19	62 01
3 in.	59 29	73 44	66 94	81 09
3½ in.	73 14	90 16	82 34	99 36
4 in.	86 66	106 82	97 56	117 72
4½ in.	0 98	1 23	1 24	1 49
5 in.	1 15	1 44	1 44	1 73
6½ in.	1 49	1 86	1 87	2 25
7 in.	1 94	2 43	2 42	2 90
8-L in.	2 04	2 55	2 54	3 05
8 in.	2 35	2 94	2 92	3 51
9 in.	2 81	3 52	3 50	4 21
10-L in.	2 61	3 26	3 25	3 90
10 in.	3 36	4 20	4 18	5 03

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.

4½" and larger 50%.

4" and under, running thread, 30%.

Standard couplings, 4-in. and under, 30%

Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices.

Per 100 Pounds.	Montreal	Toronto
Copper, light	$15 00	$14 00
Copper, crucible	18 00	18 00
Copper, heavy	18 00	18 00
Copper wire	18 00	18 00
No. 1 machine composition	16 00	17 00
New brass cuttings	11 00	11 75
Red brass cuttings	14 00	15 75
Yellow brass turnings	8 50	9 50
Light brass	6 50	7 00
Medium brass	8 00	7 75
Scrap zinc	6 50	6 00
Heavy lead	7 00	7 75
Tea lead	4 50	5 00
Aluminum	19 00	20 00
	Per Ton	Gross
Heavy melting steel	18 00	18 00
Boiler plate	15 50	15 00
Axles (wrought iron)	22 00	20 00
Rails (scrap)	18 00	18 00
Malleable scrap	25 00	25 00
No. 1 machine east iron	32 00	33 00
Pipe, wrought	12 00	12 00
Car wheel	26 00	26 00
Steel axles	22 00	20 00
Mach. shop turnings	11 00	11 00
Stove plate	26 50	25 00
Cast boring	12 00	12 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜-in. and less	10
Carriage bolts, 7-16 and up	Net
Coach and lag screws	25
Stove bolts	55
Wrought washers	45
Elevator bolts	Net
Machine bolts, 7/16 and over	Net
Machine bolts, ⅜-in. and less	15
Blank bolts	Net
Bolt ends	Net
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square, blank	add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 50
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	25 and 5
Sq. and hex. hd. cap screws	22½
Rd. and fil. hd. cap screws	plus 17½
Flat but. hd. cap screws	plus 30
Fin. and semi-fin. nuts up to 1-in.	20
Fin. and Semi-fin. nuts, over 1 in., up to 1½-in.	10
Fin. and Semi-fin. nuts over 1½ in., up to 2-in.	Net
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$60 00
Open-hearth billets	60 00
O.H. sheet bars	76 00
Forging billets	56 00-75 00
Wire rods	52 00-70 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 70
Cut nails	5 85
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 35½
British Manila rope	0 28
New Zealand hemp	0 28
Transmission rope, Manila	0 47
Cotton rope, ¼-in. and up	0 88

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net

If interested, tear out this page and keep with letters to be answered.

MISCELLANEOUS

Solder, strictly	$ 0 40
Solder, guaranteed	0 43
Babbitt metals	.18 to 70
Soldering coppers, lb.	0 62
Lead wool, per lb.	0 16
Putty, 100-lb. drums	8 30
White lead, pure, cwt.	20 00
Red dry lead, 100-lb. kegs, per cwt.	16 50
Glue, English	0 40
Tarred slater's paper, roll	1 30
Gasoline, per gal., bulk	0 35
Benzine, per gal., bulk	0 35
Pure turp., single bbls., gal.	3 60
Linseed oil, raw, single bbls.	3 00
Linseed oil, boiled, single bbls.	3 03
Sandpaper, B. & A.	List plus 43
Emery cloth	List plus 37½
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin, "D," per lb.	0 14
Borax crystal and granular	0 14
Wood alcohol, per gal.	2 70
Whiting, plain, per 100 lbs.	2 75

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes	32½
Can. carbon cutters, plus	20
Standard drills, all sizes	32½
3-fluted drills, plus	10
Jobbers' and letter sizes	32½
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	.25 off
Drills and countersinks	net
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus 20 to	40
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At warehouse]

Rounds and squares	$7 base
Hexagons and flats	$7.75 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	60	75
Class B	27	37
Class C	18	27

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 8 50	$ 9 50
Sheets, black, No. 10	8 50	9 00
Canada plates, dull, 52 sheets	8 50	10 00
Can. plates, all bright	8 60	9 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	11 00	....
Fleur-de-Lis, 28 B.W.G.	10 50	....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28	....	....
Premier, No. 28, U.S.	11 50	10 50
Premier, 10¾-oz.	11 50	10 90
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ¼ in., $9.75; ⅞ in., $9.20; ¾ in., $9.30; ⅝ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	29 50
1¾ in.	31 50	30 00
2 in.	30 00	30 00
2¼ in.	35 00	29 00
2½ in.	42 00	37 00
3 in.	50 00	48 00
3¼ in.	.. ..	48 50
3½ in.	63 00	51 50
4 in.	85 00	65 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	24½
Palacine	27½
Machine oil, per gal.	43½
Black oil, per gal.	18½
Cylinder oil, Capital	82
Cylinder oil, Acme	70
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	$2 60
Union thread cutting oil, antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil, bbls., net	13½

BELTING—No 1 OAK TANNED

Extra heavy, single and double	10%
Standard	10%
Cut leather lacing, No. 1	2 75
Leather in side	2 40

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 60
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	09
Pumice, ground	06
Emery glue	30
Tripoli composition	09
Crocus composition	12
Emery composition	10
Rouge, silver	60
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE

XXX Extra	.24	Atlas	.20
Peerless	.22½	X Empire	.19½
Grand	.22½	Ideal	.19
Superior	.22½	X Press	.17½
X L C R	.21		

Colored

Lion	.17	Popular	.13
Standard	.15	Keen	.11
No. 1	.15		

Wool Packing

Arrow	.35	Anvil	.22
Axle	.28	Anchor	.17

Washed Wipers

Select White	.20	Dark colored	.09
Mixed colored	.10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades... 15%

ANODES

Nickel	.58 to .65
Copper	.38 to .45
Tin	.70 to .70
Zinc	.18 to .18

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10..		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6 x 4 base	45 00	44 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 75	$14 50
Sheets, 3½ lbs. sq. ft.	10 50	14 00
Sheets, 4 to 6 lbs. sq. ft.	10 25	13 50

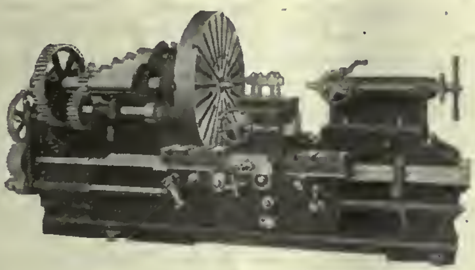
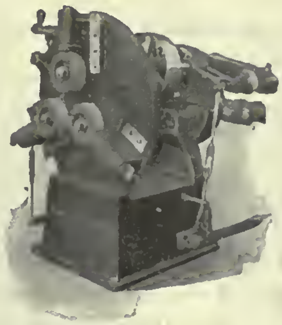
Cut sheets, ½c per lb. extra.

Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

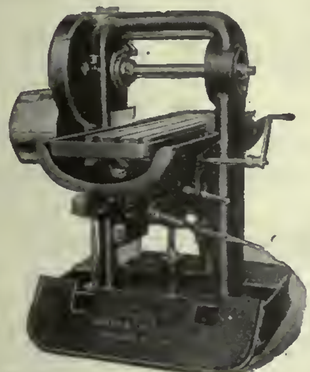
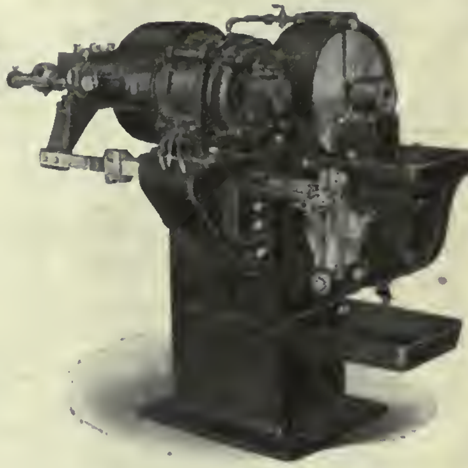
Acid, boracic	$ .23
Acid, hydrochloric	.03½
Acid, nitric	.10
Acid, sulphuric	.03½
Ammonia, aqua	.15
Ammonium, carbonate	.20
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, annhy.	.41
Copper, sulphate	.16
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.08
Nickel carbonate	.32
Nickel sulphate	.19
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.25
Silver nitrate (per oz.)	1.20
Sodium bisulphate	.11
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.18
Tin chloride	1.00
Zinc chloride, C.P.	.30
Xinc sulphate	.08

Prices per lb. unless otherwise stated


Metal Working Machinery

For Any Operation

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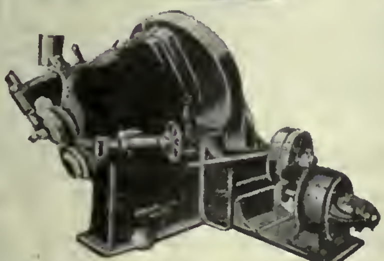
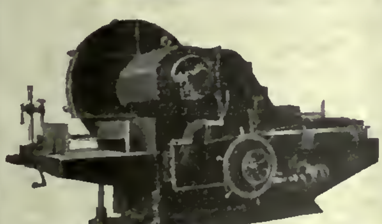
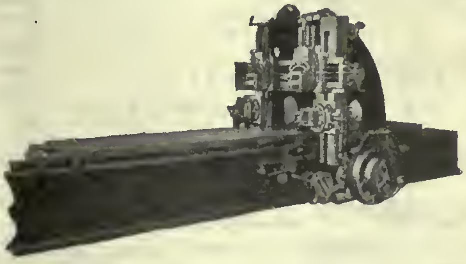
Complete equipment for Boiler Shops, Structural Steel Works, Railroad Spring Shops, Flue Shops and Woodworking Machinery of any kind.

You are undoubtedly from time to time buying new equipment. You will profit by giving us an opportunity to submit specifications.

Illustrations show a few of our machines for immediate shipment.





Garlock-Walker Machinery Company, Limited

32 Front Street West

MONTREAL TORONTO WINNIPEG

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NOW IS THE TIME FOR CANADA TO DEVELOP BRITISH BUSINESS

NORMAN D. JOHNSTON, Canadian Trade Commissioner at Bristol for the western and southern sections of the British Isles, has been in Canada for some months. He is particularly impressed with the fact that now is the time to develop Empire trade. "The present," he said, "is the golden opportunity for the laying of foundations for future trade. I have been through Canada on my present trip from Halifax to Vancouver, and have found the manufacturers generally loaded up with orders for home consumption. What I would like to say is that the indications are that this condition of affairs, the abnormal position after the war, will not continue indefinitely, and that the wise manufacturers will be those, who now that the time is ripe, take advantage of circumstances and lay the foundations for future Empire trade abroad, so that when the home market is supplied they will have overseas connections that will keep their works going."

Mr. Johnston had been at Bristol as Canadian Trade Commissioner for the past four years, and now, during the transition period between war activities and peace work, has come to Canada in order to give the manufacturers here every information he could to help them develop their export trade to the United Kingdom, and to find out what they were able to do in the way of supplying British dealers with manufactured goods.

"Opportunities for trade with England are better than ever," said Mr. Johnston. "During the war the British people got to know the Canadians as never before. They are now keen on buying goods within the Empire, other things being equal, and, so far as I have seen, they are specially anxious to improve the existing good trade relations with Canada.

"Of course adverse exchange conditions affect trade just now, but such firms as carry on at present will be the firms which will have the openings when conditions become normal and sterling gets back to its real value.

"I found that many Canadian firms were filled up with orders for home consumption," said Mr. Johnston. "But these conditions are abnormal, and Canadian firms would be wise to lay aside a proportion of their output for export to Great Britain, in order to pave the way for future export business when the home market will not be so much in evidence. Those who get the trade connection now will probably be those who will hold it later on when world trade conditions get more normal."

As to the demand in England, Mr. Johnston said it chiefly concerned the finished or semi-finished products of the Canadian natural resources, especially wood products, from lumber to wood pulp. There was also a strong demand for asbestos products, and many metal supplies, especially wire for fencing, wire nails, wire rods and similar metal work.

MANY HINDRANCES TO STEEL PRODUCTION

Steel of Canada Has Not Sufficient Coal And One Blast Furnace is Still Down

According to a statement made by Mr. Robert Hobson, president of Steel of Canada, the company is operating under serious handicaps. Only one furnace is being operated, and whereas the repairs on the second furnace would probably be completed between the middle of June and the first of July, it would not be possible to put it in blast unless the coal situation has improved very materially in the meantime. Of the by-product coke ovens, only 30 cells are being pushed at present on account of the non-arrival of sufficient coal. The amount of fuel coming forward is approximately 400 tons a day, or one-fifth of normal shipments. The only method by which deliveries can be secured is to get entire trains routed through. Somewhat less than two-thirds of the normal working force is being employed at the Hamilton plants, according to the president of Steel of Canada. While the labor problem is still prominent it takes second place to the fuel shortage with the Steel Company of Canada. A conference was arranged between the striking engineers and the company by Senator Gideon Robertson, Federal Minister of Labor, and an understanding was reached by the company executives and the strikers' committee. The company proposes to take men back in order of seniority as soon as the coal supply becomes more plentiful and additional parts of the steel plant can be restarted. Meanwhile the production situation is serious—more so than for several years—and no immediate relief is in sight.

TRYING TO GET COAL TO EASTERN CANADA

Calgary Meeting Takes Up Question of Great Interest to Ontario

CALGARY.—In answer to an appeal from the Manufacturers' Association, of Toronto, for assistance in carrying them over the present situation, caused by the attitude of the American coal operators, the delegates to the Boards of Trade Congress, meeting at Calgary, adopted a resolution, which, if acted upon, will doubtless increase the coal output of the Province to a considerable extent, and incidentally demonstrate to Ontario consumers that the products of the West are at their disposal.

Following is the resolution which was adopted:—"That every effort possible be made to increase the use of Western Canada coal, and that this conference favors the investigation of freight rates on coal from Western Canada to the manufacturing centres of Ontario, with a view to making Canada independent of any other country in its fuel supply."

It was decided to ask the Canadian Pacific, Canadian National Railways, including the Grand Trunk Pacific, to give up the freight rates for the summer haulage of coal from Western Canada, and further, to ask coal operators, if they have not already done so, to make special summer prices for the sale of this fuel.

McCLARY CO. GETS THE BUCK BUSINESS

Brantford Concern, Forty-Eight Years Old, Taken Over by London Company

London.—Official announcement was made of the purchase of the William Buck Stove Company, Ltd., of Brantford, Ont., by the McClary Manufacturing Co., of London. Negotiations were closed this week, and the transaction involves the transfer of all the holdings of the Buck Company to the London concern. Lt.-Col. W. M. Gartshore and J. M. Gunn, of the McClary Company, go to Brantford shortly to complete arrangements for the taking over of the Buck plant.

The purchase will add a force of 300 men to the McClary organization as well as a large increase in equipment, facilitating the output of both factories. The purchase will not cause the transfer of any employees of the Brantford company to London, nor will one day's operation be lost. The William Buck Stove Co., Limited, was founded by the late Wm. Buck in 1852, and continued by him until his death in 1897, when it was incorporated, since which time it has been operated by his sons, George and Philip, president and vice-president, and joint managers of the business, with C. J. Parker, C.A., as secretary-treasurer. It built and equipped the present works, and largely extended the business. The company is liquidating voluntarily and has always been able to promptly meet in full every moral and legal obligation.

Long Contracts.—It is reported that the Dominion Coal Co. has just received a contract from the Government of Holland for 250,000 tons of coal, to be shipped as early as possible. This order, following upon the completion of a similar order for the same destination, would seem to indicate that the coal and the method of filling the order have given satisfaction to Holland and the hope is that a permanent export market is being established.

HOLDS OUT NO HOPE FOR DROP IN THE PRICE OF MACHINE TOOLS

MR. A. E. NEWTON, president of the National Machine and Tool Builders Association, at the semi-annual meeting on May 20, summed up conditions in his address as follows:—

At our last convention we were rather surprised that business conditions had held so favorably since the signing of the armistice. We had been promised, and most of us had looked forward to a real depression, at least, in our own line of industry.

We thought so many machine tools had been produced during the war period, and that so many of those were to be released by our Government, that it was reasonable to believe that we should have to meet an over-supplied market. Fortunately for us, things have turned out quite different. Instead of the depression, we have experienced a most unusual and an easy-selling market, and have had a very prosperous half year.

Government-owned machine tools have not unduly flooded the market, excepting those of educational institutions. An absorption of a large quantity of machine tools by these various schools is bound to benefit the whole country.

The need for mechanical training is greater to-day than ever before, and it will be still greater in coming years. I believe that we are just starting a new period of trade and technical school development, and that the importance and necessity of these institutions is becoming more and more apparent, because of our actual dependence upon machinery and mechanical devices, for the maintenance of our present, and any future betterment of our living conditions.

To-day, most of us are experiencing a shortage of new orders, although having plenty of unfilled orders on our books.

I am looking forward to the resumption of good business conditions in a few months. In other words, if we are to have a business depression, it will be of short duration.

The price-cutting wave now attracting attention throughout this country, is caused by the calling of loans, or the refusal of loans, rather than the oversupply of materials; and in most cases these same materials which are being disposed of by the retailers, could not be replaced at a price as low as they are now being sold.

In the machine tool industry, I know that we could not in the near future, replace our inventories of finished and semi-finished materials at anywhere near the cost of our present inventory.

CANADIAN VICKERS LAUNCH A NEW VESSEL FOR NORWEGIAN FIRM

THE fourth vessel, built by Canadian Vickers, Limited, for Norwegian interests, was launched by Miss Ida Bodin, sister of the Resident Surveyor of the Nodwegian Veritas in Montreal.

The vessel, which is named "Loch Tay," was built for Mr. Alf. Monsen, Toensberg, under the supervision of Capt. Andersen and Engineer Haugerud for the owners, and Mr. F. H. Bodin, representing Mr. Hans Johnsen, Chief Surveyor of the Norwegian Veritas. She will be completed and ready for cargo in about three weeks.

The vessel is 413 ft. over all, has a beam of 52 ft. and is 31 ft. ⅞ in. deep. Her draft, when loaded with 8,300 tons of cargo, will be 25 1-3 feet. She is fitted with triple expansion engines and three Scotch boilers, adapted to burn either coal or oil fuel, boilers being fitted with Howden's forced draft system. About 1,500 tons of fuel oil are carried in the double bottom tanks and in a deep tank amidships.

The equipment for hanlding cargo is up to date in every respect; the cargo winches and windlasses being of Clarke-Chapman design, the steam steering gear being of Hastie horizontal type, all manufactured by Canadian Vickers, Limited. Steering from the navigating bridge is by means of a telemotor of MacTaggart-Scott type, made by Robert Mitchell Co., of Montreal, and also by hand steering gear on the poop deck. There is the usual complete equipment of mechanical engine-room and steering telegraphs.

The equipment and accommodation for officers and crew are very complete, being up to the latest requirements of the Norwegian Sea Control Authorities. In addition to the ordinary equipment of boats, one of the life-boats is equipped with a gasoline motor, and there are also two life-rafts.

Miss Bodin who was accompanied by her brother, Mr. H. Bodin, was received on behalf of Canadian Vickers, Limited, by Mr. A. R. Gillham, the managing director, and Mr. P. L. Miller, the general manager.

Agency Wanted.—E. C. Beuthin, Commissioner Street, Johannesburg, writing to CANADIAN MACHINERY, says: I shall be glad if you can put me in touch with any Canadian manufacturers of mild steel plates, bar iron and steel, tool steel, spring steel, or belting, either leather or Balata, who require representation in South Africa, or who are desirous of opening a branch in this country. Mr. E. H. Barton, the buyer of the Rand Mines, Ltd., will give any references that may be required as to my ability and knowledge of the work. Any other information desired I shall be pleased to give direct."

MOVED TO NEW QUARTERS

The Page Steel & Wire Co. of New York have moved their previous quarters to the offices of the American Chain Co., with whom they have consolidated Their new address is Suite 1054 Grand Central Terminal, New York.

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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Vol. XXIII., No. 23 June 3, 1920

Manufacturing Accurate Screw Products

Herein Is Described Portion of Plant of the John Morrow Screw and Nut Co., Ltd., Devoted to the Manufacture of Screw Products. Examples of Work, and Interesting Fixtures Are Shown.

—By J. H. MOORE

A WELL lighted factory, interesting work amid pleasant surroundings, together with adequate wages, all make up for contented workmen. This combination of conditions is not found as easily as one would imagine, but every one of the already named requisites are present and self-evident in all plants under the control of "The John Morrow Screw & Nut Co., Ltd., Ingersoll, Canada."

The factories are divided into three sections; the screw department, the drill department, and the nut department. Each section carries a factory number and for the purpose of this article we will take up the screw producing section first, this portion being known as Plant No. 1.

The first important point that impresses one on going through the plant is the construction and adequate light provided. Every corner of the various floors receives good natural light and the question of proper arrangement of artificial lighting has also been carefully attended to.

Another feature clearly noticed is the well-laid-out lines of machinery. No haphazard methods have been adopted, for each machine has been placed according to a well-thought-out plan. Sufficient aisle space has been allowed in every case, so that there is no congestion of material around the machines.

To prove our contention and illustrate how carefully the subject of machine layout has been considered let us refer to Fig. 1. This view shows a portion of the ground floor, where the cross drilling, tapping, head finishing, etc., etc., is performed. Girls operate the majority of these machines, and the well-laid-out machinery and the wide aisle space, etc., need no further comment, as all these details can be noted from the photograph.

It can be easily understood that a plant of this nature requires a considerable number of jigs, fixtures, form tools, and so on. This class of work is accomplished in the tool room and Fig. 2 illustrates a small portion of this room. Expert mechanics and first-class equipment ensure the very best of fixtures, etc., coming from the department.

Any attempt to mention the variety of work handled by this concern would be futile, so we will content ourselves by repeating what they replied to our query, "How many types of screws, etc., do you manufacture?" If it's a screw, a pin, a nut, or in fact if it's a job for the automatic or turret lathe, we can manufacture it. We are ready to manufacture all classes of milled screws, and special milled work from iron, steel, or brass."

This covers quite a large field, but of course, as can be readily be understood, they carry their standard lines of Button Head, Hexagon Head, Square Head,

FIG. 1—SHOWING A PORTION OF THE GROUND FLOOR.

FIG. 2—A SMALL SECTION OF THE TOOL ROOM.

FIG. 3—ILLUSTRATING ONE OF THE MANY LINES OF AUTOMATIC MACHINES.

Round Head, and Flat Head cap screws. Collar screws, coupling bolts, hollow set-screws, ordinary set-screws, studs, taper pin, thumb screws, etc., etc.

Screw work is generally accomplished on automatic, or semi-automatic lathes. Fig. 3 gives a good idea of the appearance of a small portion of one of these lines of machine tools. Note the accurate layout, also the quarter twist belt drive. Every variety of screw conceivable is made on these machines and one operator usually attends to a battery of machines.

Some Examples of Work

Fig. 4 illustrates an example of cap screw work on a single spindle machine. By closely looking at this picture, the finished product can be noticed, heaped up on the cross slide.

At Fig. 5 we show a Radical Multi-Spindle automatic making 9-16 in. S.A.E. plain nuts. Briefly the tooling operates as follows: The first station is that of centering. Next comes drilling part way. Thirdly, the hole is drilled the remaining distance. Now comes the chamfering and part way cut off, Last of course comes the final cut off, and setting of stock to new position. In this machine the work heads revolve and not the tooling. The production from the machine is in the neighborhood of 2,300 to 2,500 nuts per ten hours.

The example shown at Fig. 6 is that of manufacturing S.A.E. castle nuts on a B. and S. automatic. The operations consist of centering, drilling, forming and cutting off. While the cut-off tool is at work, the arm A goes down, and by means of a little jaw, picks the nut away from the bar stock as soon as it is cut off. This arm now rises, and places the nut in the castellating attachment. This attachment is operated from the wheel B partially shown in the photo. By means of an indexing cam plate, together with a small cutter, the six castellations are made in the nut, and it drops a finished product with the exception of inspection.

Fig. 7 shows a 5-spindle automatic of the plant's own make. They have quite a number of these machines in use, and it might be well to add at this point that they often make their own machinery when advisable. The work being performed in this picture is the producing of hanger set screws. These screws have 4 in. of thread, and are ⅝ in. in diameter. The operations are obvious, namely, turning, forming head, and threading. Two dies are used for threading in order to ensure a perfect thread.

The next view, shown at Fig. 8, is another example of set-screw work. In this case the work is turned up part way and necking tool operated from cross slide. Next comes a combination tool which turns the balance of the screw, also points the cup end shown. Third comes the first threading die. Fourth comes the second and final threading operation, while the fifth position feeds out the stock.

Some Interesting Fixtures

It has always been the policy of this firm to simplify as much as possible their various fixtures. In place of using huge gang fixtures, they prefer to use single purpose fixtures. From experience gained they have proven this to be the best method, as the set up is simpler, the tooling is easily replaced, etc., or in other words the benefits are numerous.

Take for example the castellating fixture shown at Fig. 9. This is rigged up on a small hand miller and is almost ridiculous in its simplicity, yet wonderful in results. The fixture consists of a body A through which goes a spindle. On the end of this spindle towards the cutter is placed a jaw of similar shape to the nut to be castellated. On the other end of the spindle is placed an indexing wheel B. This wheel has six slots cut into its rim, 60 degrees apart. Directly below the wheel is a pin or spring plunger which indexes the wheel as it comes around. The idea is obvious, so no further explanation is given on this point. Note the pin at C. This is what is termed an ejector pin. On the nut being completed, the operator brings his table back until this pin hits a bracket (shown on photo). This pin then ejects the nut without the operator's hand going near it. To make sure that the nut is kept in position while being castellated, a small spring steel finger holds it securely in position. This finger cannot be seen on the photo as it is between the milling cutter and the nut.

Before installing this fixture the firm under discussion tried numerous ways to speed up production, and still get a perfect product. Gang fixtures were made and tried out, but the upkeep of cutters, and the expert set-up necessary, etc., were very objectionable features. Since having this fixture in operation, production has increased three times the former figure. On the ⅜ in. size nut

FIG. 4—A SINGLE SPINDLE AUTOMATIC ON CAP SCREW WORK

5,000 to 6,000 nuts can be castellated in a 10-hour day. High speed cutters are used, and this production figure is an enviable one indeed. It is impossible for the operator to go wrong once the machine has been set, for there is a positive stop on the side of the table to regulate the depth of cut.

Another feature of unusual note is shown at Fig. 10. This could well be called a centreless grinding machine. As can be noticed it consists of an ordinary wet grinder rigged up for a special purpose. Briefly it consists of a guide block with three strips to hold the work in position. Each of these guides are adjustable, so that any diameter within the range of the jaws can be accommodated. Piston pins, king pins, or in fact any ordinary pins without shoulders can be ground on the fixture. Various sets of jaws are made, ¼ in. to ½ in. capacity, ½ to ⅞ capacity, ⅞ to 1⅜ capacity, and so on. In the picture shown we have removed the splash guard in order to illustrate clearly the construction of the fixture.

In operation the procedure is very simple. Feed the work in at one end, and the motion of the wheel carries the work with a revolving motion to the other end, when it falls out into a box as shown. It is hardly necessary to enumerate the advantages of a fixture of this nature, for it does away with all centering operations. Over the former method of grinding these pins, on the regular type grinder, this fixture has saved the firm considerable money, as it is 500 per cent. faster.

The Oil Supply System

It might be well to touch on the system adopted for supplying and reclaiming oil. It can be easily understood that a firm of this size are large users of oils, so it is imperative that a close tab be kept on expenses of such nature, and these held to a minimum.

Underneath the floor of the plant is placed a 10,000-gallon tank of screw cutting oil, and a 12,000-gallon tank of fuel oil for the furnaces. A large tank for reclaimed oil is also placed on the roof. The new oil from the lower tank is drawn by Bowser pumps whenever necessary, but if at all possible, reclaimed oil is used.

This reclaimed oil is saved by the separating process; and Fig. 11 illustrates one of these machines.

Not only is oil reclaimed in this room, but the product, which often loses itself in the cuttings. This is especially true if the product is small. The method of procedure is as follows: The cuttings are brought in on trucks from the factory, and placed in riddles, which rest on the three bars shown on the photograph.

The workman now shakes the riddle until the finer cuttings have dropped out, when he can readily see if any of the product has been hidden in the coarser cuttings. If so, he picks them

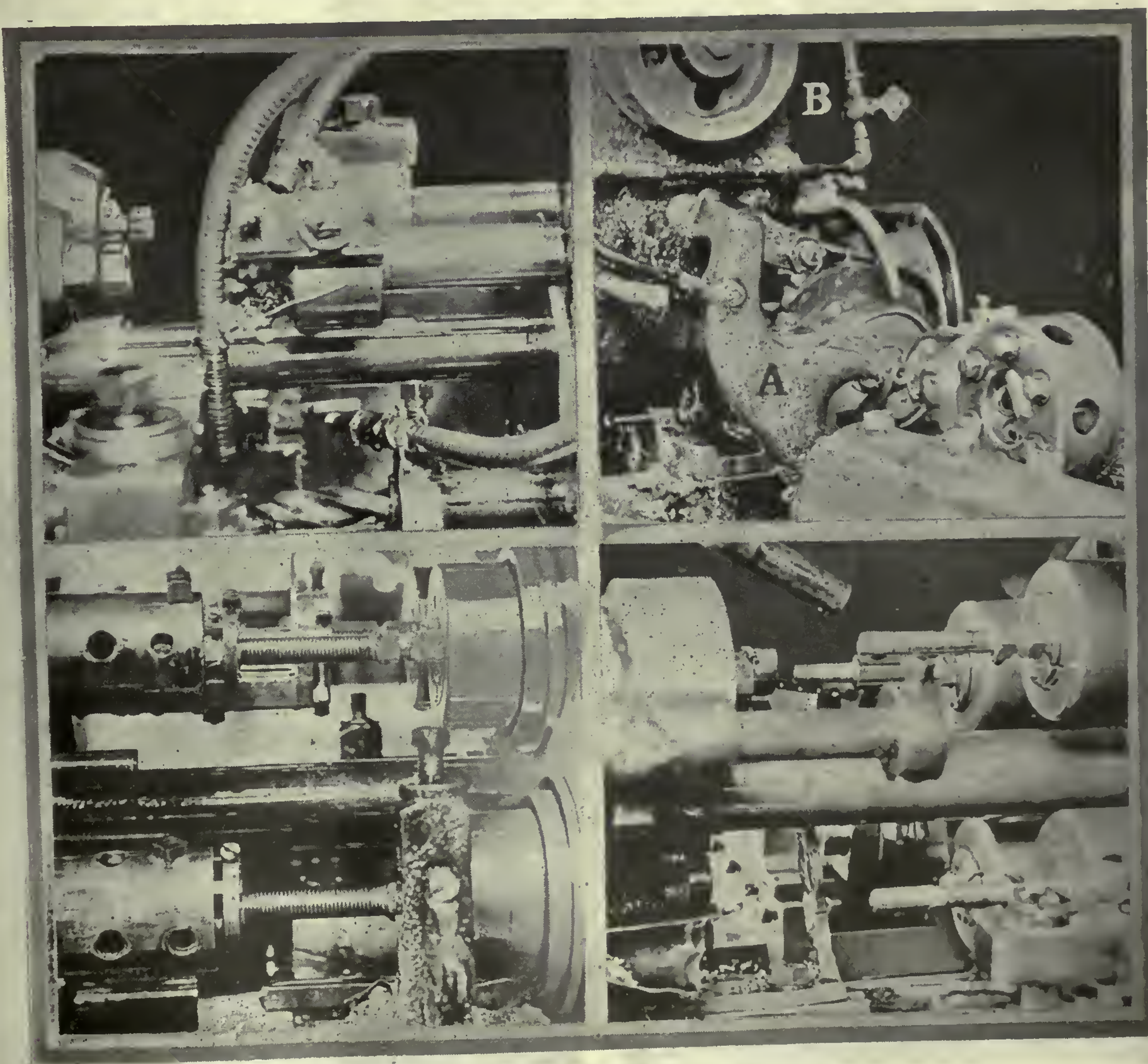


FIG. 5—UPPER LEFT, SHOWING THE MANUFACTURE OF S.O.E. PLAIN NUTS.
FIG. 6—UPPER RIGHT, SHOWING THE MANUFACTURE OF S.A.E. CASTLE NUTS.
FIG. 7—LOWER LEFT, SHOWING A FINE SPINDLE MACHINE PRODUCING SET SCREWS.
FIG. 8—LOWER RIGHT, ILLUSTRATING ANOTHER EXAMPLE OF SET SCREW WORK.

out, drops them down the chute shown at the side of main bin, where they fall into a tin pan underneath ready to be washed.

The cuttings are next piled in the separator bucket, lowered into the machine and the oil extracted. Usually two minutes completes this operation. When oil has been reclaimed it is put in a tank and cleaned and purified before being pumped up into the tank on the roof. On each floor are placed Bowser pumps in handy position to the machines, and the operator can draw whatever quantity he desires. This oil comes from the upper tank by the natural law of gravity, and the arrangement described results in quite a saving, as there is practically no waste oil whatever.

Other Features of Interest

The method of storing the stock for their various products is well worthy of note. Special racks are used with spaces of about 2 ft. square. Each section is numbered and indexed as to size and length of bar. Close tab is kept of stock used, and stock on hand. In this way they know exactly where they stand, how much stock is used every month, and how much new stock is required to replenish the rack.

When an order goes out to the factory a card is filled out to that effect, and if necessary the promised date of delivery is marked on this card. With each order to the shop, an envelope containing a sample of the piece desired is sent out. On the envelope is stated all particulars, so that the machine operator and foreman thoroughly understand what is wanted.

FIG. 11—ILLUSTRATING HOW THE OIL IS RECLAIMED FROM CUTTINGS.

For carbonizing and case hardening, this company have installed five furnaces of their own make. Fuel oil or natural gas or oil is used and the supply is drawn from the tank in the basement.

To facilitate handling the various products, tote boxes are employed throughout the entire plant. These boxes are really the old style boxes used for toting around shells so that here is a peculiar case of a war-time article used for a peace-time industry.

Double disc grinders are employed for grinding the heads of cap screws, and other similar work, and where necessary oscillating grinders are adopted for special grinding of tappets and cones.

A very handy system of loading the cuttings on cars is employed at this plant. After the oil has been separated the dry cuttings are shovelled down a chute alongside of separating machine. This chute leads to the railway siding and of course the material drops right into the cars.

In addition to the regular departments there is a plating room, where products can be plated if necessary.

Storerooms are located at variou points throughout the plant, with a view to efficiency, and they have been so arranged that the desirable condition of no lost motion has been obtained.

Another point worthy of mention is

FIG. 9—A CASTELLATING FIXTURE USED ON A HAND MILLER.

FIG. 10—A NOVEL CENTERLESS GRINDING MACHINE.

the thought exercised in the planning of the different equipment. On the ground floor is placed the hand machines, turret lathes, finishing department, and inspection room. The second floor is devoted to single and multiple spindle screw machines, while the third floor is taken up by the tool room.

Inspection Department

A very important portion of the plant is the final inspection department. Of course, as can be understood, numerous sub-inspections transpire throughout the process of manufacture, but the final inspection is both important and exacting.

In this room every screw is carefully gone over and the product must be perfect before it receives the inspector's approval. The concern spoken of pride themselves on the quality of their goods, and they can well afford to, as their system of inspection is very exacting.

A clever card system is employed to keep track of work passing through the plant. A card is made out, and kept in the office. On this card is marked the order No. and the customer's name, each operation, description of piece, workman's number, kind of steel used, the weight of same, the total cost, and the number of pieces received and finished. In this way tab is easily kept on any loss of stock and the reason for the loss.

In concluding the article on the screw manufacturing portion of this plant, let us ask readers what may seem a peculiar question: "Have you ever had the pleasure of watching a college boat crew rowing their college to victory on regatta day?" If so you will have noticed the harmony and willing spirit shown by each member in the crew. The strokes were even and definite, each stroke counting in the final victory. Many a race has been lost through an uneven stroke.

From college boat races to a manufacturing plant seems like a strange jump, but the only parallel that appeared suitable to conditions existing in the plant we refer to, was the college crew. Just the same as they pull together, every employee in this organization pulls together. A very new and novel bonus system is in force throughout these plants, and the workers benefit favorably when the production reaches the maximum point. A certain production figure is decided upon, and all over that mark is divided in a very fair manner to all employees; but not to the executive staff. The writer of the article personally heard such remarks as "Hey, Jack, speed up, will you, remember it's near the end of the month." "Say, there, get a hustle on, will you, you're holding the next operation behind." There were quite a few remarks overheard, but why repeat them. These two give a fair idea of the go-ahead spirit existing, so that all we can add is, that this same spirit exists in all the plants under the Morrow management.

In our next article we propose taking you through the drill-making section, which is especially interesting.

How Should We Lubricate Ball Bearings?

Conclusion of an Article on This Subject Presented in Previous Issue. Various Tests Are Described, and the Make-up of Lubricating Greases for Ball Bearing Use Is Given.

By H. R. TROTTER

EMULSION Test.—This test gives a very definite indication of the presence of sulpho compounds in an oil (sulphuric or suphonic). There are several methods for carrying out this test, but for routine work the following method for motor oil specified by the War Department in Specification No. 3502 issued April 24, 1918, should be followed:

One ounce of the oil shall be placed in a standard four-ounce bottle with one ounce of distilled water. The mixture shall be heated to a temperature of 180 deg. Fahr. and then shaken vigorously for five minutes. After standing for one hour the oil must be clear and of the same color as before the test. All of the water must have settled and appears only slightly cloudy.

This method is simple and gives valuable indications as to degree of refinement of the oil. Highly refined oil shows a thin white line of demarcation between the oil and clear water below, thus indicating the absence of sulphuric acid compounds. Impure oil mixes permanently with water, appearing often as a curdled mass floating on milky water. The curdled portion contains what is frequently called a sulphuric acid soap, and the extent to which it is present is an indication of the quantity of the "sulpho" compounds left in the oil, due to improper refinement. Oils containing appreciable amounts of these sulpho compounds are unsuitable for ball bearings.

Heat Test.—This test is conducted by heating a small portion of the oil in a flask or beaker up to the flash point and holding it at this temperature for fifteen minutes. A comparison is made between the heater and unheated oil. Highly refined oil darkens slightly but does not deposit sediment on standing twenty-four hours. Oils that contain sulphuric acid compounds turn black and deposit carbon-like substances. Such oils are not suitable for ball bearings.

Inflammability Test.—A flash point of 300 deg. Fahr. (open cup) is the lowest limit considered safe for ordinary work, and, on installation subject to high temperatures, oils having a flash point above 100 deg. Fahr. should be used. The fire hazard is the factor to be considered in specifying the flash and fire tests.

Cold Test.—For installations running at low temperatures asphaltic-base or low-pour-test oils are recommended as this type of oil shows pour test of 5 deg. Fahr. or below, while the paraffin-base oils do not ordinarily run below 30 or 35 deg. Fahr.

Lubricating Greases for Ball Bearings

Most of the high-grade mineral oils conform quite closely to the above specifications. In connection with lubricating greases, however, the problem is more difficult. Many of the greases now on the market are entirely satisfactory for general purposes, but lack certain characteristics which experience shows to be highly important for successful ball-bearing lubrication. Tables 1, 2 and 3 show the variations to be found in a number of lubricants on the market, and it includes a sufficient number of analyses to show characteristic variations

TABLE 1—LIME-SOAP GREASES

Mark	Mineral Oil,	Neutral Saponifiable Oil, per cent.	Lime Soap (calc. as calcium oleate), per cent.	Free Lime, per cent.	Free Acid (calc. as oleic acid), per cent.	Moisture and Undetermined, per cent.	Melting point, deg. fahr.
130,849	67.23	0.42	27.18	1.53	0 05	3.56	210
131,859	84.56	0.10	10.72	0.15	0.04	4.43	190
131,860	86.35	0 32	8.76	0.09	0 04	4.44	165
131,574	88.31	1.55	8.15	0.19	0.07	1.73	103
141,537	74.04	0.95	19.13	0 21	0.03	5.64	182
142,543	74.49	2.03	17.94	0.30	0.08	2.16	170
141,544	82.00	4.72	10.72	0.03	0.07	2.46	151
132,255	65.76	5.64	21.29	0.53	0.76	6.02	202
132,254	81.62	0.56	15.85	0.20	0.14	4.65	158
141,533	78.88	1.05	17.82	0.22	1.16	2.94	157
141,535	75.46	1.11	17.82	0.37	0.51	4.73	177
143,008	83.09	1.10	13.12	0.23	0,30	2.07	174

TABLE 3—SODA-SOAP GREASES

Mark	Mineral Oil, per cent.	Neutral Saponifinable Oil, per cent.	Soda-Soap (calc. as sodium oleate), per cent.	Free alkali (calc. as sodium oleate) per cent.	Free Acid (calc. as oleic acid), per cent.	Moisture and Undetermined, per cent.	Melting Point, deg. fahr.
132,736	98.13	0.60	0.70	absent	0.05	0.52	Fluid at rm. temp.
132,738	95.02	0.32	3.69	0.01	absent	0.96	98
134,136	92.60	0.30	6.10	absent	0.06	0.94	110
135,863	53.60	28.88	5.17	absent	0.14	12.21	108

TABLE 2—LIME-SODA GREASES

Mark	Mineral Oil, per cent.	Neutral Saponifinable Oil, per cent.	Lime-Soap (calc. as calcium oleate), per cent.	Soda-Soap (calc. as sodium oleate), per cent.	Free Acid (calc. as oleic acid), per cent.	Free Alkali (calc. as sodium - hydroxide), per cent.	Free Lime, per cent.	Moisture and Undetermined, per cent.	Melting Point, deg. fahr.
134.705	74.28	0.42	19.09	1.78	absent	0.014	0.65	3.76	205
134.710	77.30	...	0.71	19.76	absent	0.013	0.52	1.697	205
134,711	85.38	0.40	11.02	0.95	absent	0.002	0.13	2.118	192
134,712	90.44	0.53	6.80	0.77	absent	0.006	0.04	1.414	114
134,713	84.26	0.50	2.17	11.04	absent	0.002	0.22	1.808	160
141,536	72.82	1.20	18.42	1.88	0.57	absent	0.05	5.06	186
141,538	84.70	2.15	9.12	1.14	0.42	absent	0.40	2.43	183
141,540	78.00	3.95	14.34	1.52	absent	0.004	0.57	1.606	189

in the different types of greases available.

A large number of greases contain lime soap as thickeners, a few are of the soda-soap type, while others are a combination of both. The lime greases are valuable in that they can be used without harmful results where moisture is present. Their consistency, however, is more easily changed by heat than greases of the soda type.

Using the tests previously mentioned as a basis, we can very easily arrive at a suitable specification which will insure the production of lubricants suitable for ball bearings without putting any undue burden on the lubricant manufacturer. The following specifications are accordingly suggested:

Free acid (calc. or oleic acid), maximum, 0.10 per cent.

Free alkali (calc. as sodium hydroxide) maximum, 0.10 per cent.

Free lime (calc. as calcium oxide), maximum, 0.5 per cent.

Neutral saponifiable oil, maximum, 1.0 per cent.

Viscosity of mineral oil (minimum 200 sec., Sayholt Universal, 100 deg. Fahr.).

Abrasive particles (sand, etc.), absent.

The determination of acidity in a grease containing lime soap require special treatment and the following modification of Marcusson's method is strongly recommended:

Ten grams of the grease are carefully weighed into an extraction flask and dissolved in 88 deg. gasoline by shaking cold (it is well to dissolve cold, as by heating or boiling some of the free lime may combine with the free acid). Allow the soap to settle and pour clear gasoline solution on medium larger filter without stirring the soap; treat the insoluble soap, lime, etc., again with gasoline; thoroughly shake and allow to settle clear; pour on filter paper and when filtered wash soapy residue into filter paper and wash several times with gasoline until all soluble is washed out. Filtrate and washings are caught in an Erlenmeyer flask of sufficient capacity; the gasoline solution is slowly distilled off on electric hot plate, being careful not to carry down too far so as to break up the oils. The residue is washed into a stoppered bottle with a small amount of gasoline and 50 cc. of 50 per cent. neutral alcohol added and titrated with standard N/100 sodium hydroxide solution, shaking the mixture thoroughly after each drop of solution is added, using phenolphthalein as an indicator. By this method, the acid content can be determined within 0.02 per cent., calculated as oleic acid.

Ball bearing manufacturers are quite agreed that the limit of free acid in a grease should not exceed 0.10 per cent. calculated as oleic acid, and from the foregoing tables it is evident that there are plenty of greases available which meet this requirement.

It is essential that the grease be comparatively free from unsaponified fatty oil, or, as expressed in the analyses, "neutral saponified oil." This specification is imposed because the unsaponified fatty oil has a tendency to become rancid or develop an acidity with age in service, particularly when operating at high temperatures. We have established a limit of 1.0 per cent., and the above tables shows that this can be met in most of the compounds which are suitable in other respects.

One feature of grease lubrication which cannot be too highly emphasized is the importance of using a high-grade mineral oil conforming to the tests for purity as previously outlined. A grease may be perfect in every other respect, yet if a poor grade of mineral oil is used the life of the bearing will be shortened.

Some manufacturers take advantage of the fact that a grease made with kerosene looks much the same as one containing high-grade oil and cheapen their product by using inferior light oils. It is desirable that a highly-refined oil showing about 200 sec. viscosity Saybolt Universal at 100 deg. Fahr. be used in the ordinary grease formula

In view of the high polish necessary on ball bearings, the elimination of abrasives such as sand particles, etc., is manifestly important.

At the present time there is no generally accepted method for determining the consistency or melting point of a grease. Grease manufacturers have adopted systems of nomenclature peculiar to their product, but not directly comparable to any other manufacturer's product. In the absence of a standard test, the adoption of the method for determining the melting point described by Gillett is urged. (See "Journal Industrial and Engineering Chemistry," 1909, page 351.)

This method makes use of an open capillary tube 4 mm. inside diameter and about 8 cm. long, graduated at 1 cm. and 5 cm. from one end. The tube is stuck into the grease, and, if necessary, suction is used at the same time to draw up a plug of grease 1 cm. into the tube. The tube is then attached with a rubber band to a thermometer so that the grease plug is beside the bulb. The thermometer and tube are immersed in a beaker of water so that the bottom of the tube is 5 cm. below the surface of the water, and the water is heated at a rate of 3 to 4 deg. per min. When the melting point is reached, the plug, which is under a pressure of 5 cm. of water, slides upward in the tube.

By itself this test means very little, but when made in conjunction with a complete analysis of a grease it enables one to check up the uniformity of the manufacturer's product on various lots of the same grade and gives some idea of the temperature under which the grease will operate. The melting point as determined above is dependent upon the nature and amount of soap, oil, and water in the grease as well as the processes used in combining the various constituents of the grease.

It is also desirable to keep the free-lime content of the grease down to a minimum as any excess detracts from the lubricating qualities of the grease. Experience indicates that 0.5 per cent. is a desirable limit. In some of the greases that the author has examined, small lumps of free lime were discovered to be distributed throughout the grease.

The highest-grade ball-bearing greases are put through a milling process after compounding. This treatment insures very intimate mixing of all constituents and pulverizes any chance impurity to an impalpable powder. It is strongly recommended that all greases for ball bearings be so treated.

Graphite as a Lubricant

Graphite, despite its unctuous qualities, cannot be regarded as a true lubricant. It can, however, be used with success in plain bearings as it fills in the interstices in the bearing surfaces and allows the true lubricant to operate efficiently. A modern well-made ball bearing with mirror-like finish has, however, practically no interstices in the balls and raceways. A perfectly finished ball shows no scratches when magnified 100 diameters, and, furthermore, were there irregularities present graphite would not eliminate them as there is considerable difference between the sliding action of a plain-bearing and the rolling action of a ball bearing.

Graphite, moreover, has a tendency to pack in the ball retainers and raceways, and a bearing which has been lubricated with graphite grease generally has a distinct wavy appearance in the ball paths. A recent brief test of a grease containing graphite revealed the fact that while the graphite did not pack in the raceways, and the wavy ball paths were absent, the complete raceway presented a burnished appearance quite different from that obtained by the use of ordinary greases. The graphite packed hard in the ball retainer and could not be removed by dipping in gasoline.

The use of graphite in ball bearings cannot, therefore, be regarded as beneficial, and its application is purely a question of economics. Its use in ball-bearing automobile transmissions and rear axles is advisable only if the increased efficiency and life of the gears offset any possible harmful effect on the bearings.

Analysis of Lime-Soap Greases

The procedure for analyzing lime greases is not a simple one and the following suggested form may prove of interest. The ordinary constituents of a lime grease are:

(a) Mineral oil
(b) Saponifiable oil
(c) Free lime
(d) Free fatty acid
(e) Moisture
(f) Soap.
} Original state.

Determination of Total Fatty Matter.—Weigh 10 grams of the grease into a 250-cc. extraction flask, add 50 cc. water and 5 cc. of hydrochloric acid. Boil on hot plate for one hour or until the soap is completely broken up. Make sulphuric ether extraction, leaving:

(a) Mineral oil
(b) Neutral saponifiable oil
(d) Fatty acid.
} Second stage

Determination of Total Acidity.—Add 50cc of neutral alcohol, heat under reflex condenser for fifteen minutes to dissolve fatty acids and titrate with standard alkali using phenolphthalein as indicated. The standard alkali used in the titration is calculated to oleic acid which gives a total of fatty acids combined as soap and free fatty acids existing in the grease, leaving:

(a) Mineral oil
(b) Neutral saponifiable oil.
} Third stage.

Determination of Neutral Saponifiable Oil.—To the contents of the flask from the above determination, add 25 cc. of standard alcoholic caustic potash solution and boil under reflex condenser for two hours. Titrate the excess of caustic potash with standard hydrochloric acid and calculate the number of milligrams of caustic potash used up by the neutral saponifiable oil. The neutral saponifiable oil is then calculated from the saponification number, leaving

(a) Mineral oil } Fourth stage.

Determination of Mineral Oil.—Add 10 cc. of standard alcoholic caustic potash solution to the contents of the flask used in the previous determination and boil under reflex condenser for one-half hour. Cool and make petrolic ether extraction. Ether extract contains the mineral oil.

Determination of Ash Content. — Weigh 10 grams of grease in a platinum dish. Burn to ash over gas burner. Residue may contain lime, lead, sodium, sand, potassium, silicates, iron, aluminum, mica, tac, or mineral filler. Weigh residue and add hydrochloric acid. Heat and filter. Residue contains sand, silicates, mica, talc, etc. The filtrate contains iron, aluminum, calcium, sodium potassium, etc., and should be made alkaline with ammonia, then boiled and filtered. Residue is iron and aluminum. Filtrate contains calcium, sodium, and potassium. Add excess of ammonium oxalate to filtrate, and filter. Residue contains lime in form of calcium oxalate, filtrate contains sodium and potassium.

While the bases used in the soap may be determined by the usual chemical methods as indicated above, microchemical methods are quicker and more delicate for qualitative tests and in some instances the latter method represents the only practical means of determining very small amount of the bases used. Chamot in his book on Elementary Chemical Microscopy gives a complete and detailed account of the methods to be used in microscopic analysis.

It might be of interest in this connection to examine the microphotographs of various greases, and for that purpose Fig. 10 is given in which A shows the crystals of calcium sulphate obtained from a lime-soap grease; B crystals obtained from a soda-soap grease; C crystals obtained from a lead-soap grease, and D crystals obtained from a potash-soap grease.

In conclusion, the author would like to point out the need for further investigations to obtain data so that lubricating-grease specifications may be standardized. The lubrication problem is essentially a chemical problem and we should welcome the assistance of the chemical societies in this matter.

For the purpose of clearing away the debris in the headings of a tunnel being constructed in California, steam navvies worked by compressed air are being used. The tunnel, 3¼ miles long, is for a hydro-electric scheme, has a section 17ft. by 17ft., and is driven largely in solid granite. The shovels have dippers of 21 cubic feet capacity on 13ft. booms, and, on the average, clear away the 150 cubic yards of rock brought down at each blast in eight hours.

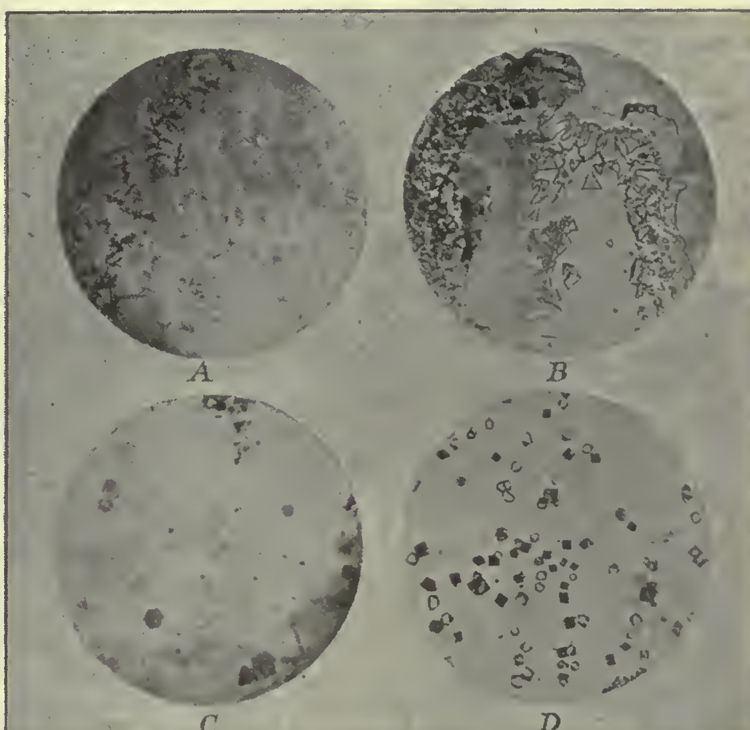


FIG. 10—MICROPHOTOGRAPHS OF VARIOUS TYPES OF GREASES.

Locomotives for Use in Norway and China

This Data Will Be of Particular Interest to Our Railroad Readers, Who Will More Than Likely Compare the Specifications of These Engines With Those of American Practice.

DURING the past year, says "Engineer," the Baldwin Locomotive Works of Philadelphia, Pa., U.S.A., has continued to construct a large num-
This locomotive trade, which was tives for export. This trade, which was well on the road to development before the war, received a considerable impetus during the general dislocation, when America was one of the most important suppliers in meeting the requirements of the Allies for this class of product. Since then the trade has continued at a brisk level, and during 1919 the Baldwin Works turned out for foreign buyers both engines built in accordance with their own practice and also to the specifications and designs of the purchasers.

In Figs. 1 and 2 are illustrated two such locomotives recently completed. The first is a 4-6-0 type superheater locomotive for the Norwegian Trunk Railway, while the second (Fig. 2) is a 4-6-2 locomotive for the Peking-Mukden Railway, China. The former locomotive follows in a general way American practice, while the latter follows European practice to a greater degree.

The Norwegian engine is one of two built for passenger service. The average weight on each driving axle is 16 tons, and the tractive force exerted, calculated on 85 per cent. boiler pressure, is 26,300 lb. The ratio of adhesion is approximately 4. The boiler pressure is 170 lb. per square inch, and the cylinders are 22.05 in. by 23.62 in. stroke. The boiler has a comparatively short barrel, the length of the tubes being 12 ft. 6 in. The frames are of the bar type, of cast steel, and the fire-box is placed above them, and between the driving and trailing wheels. This gives a box rather wider than is possible in European practice, but a good deal narrower than modern American practice. The grate, however, is 26.4 sq. ft., which is ample for a boiler of this size. The tubes and fire-box are of steel. The crown sheet is arched and radial-stayed. The coupled wheels are equalized. Driving and crank-pins have been heat treated. The pistons are of cast steel. The weight of the reciprocating and revolving parts has been reduced as far as possible. The valve motion is of the Walschaert type, controlled by screw gear. The equipment of these locomotives include the vacuum brake, with auxiliary hand brake, speed recorder, mechanical lubricators, etc. The cab is arranged so that it can be entirely closed in, and will be seen to afford the men good protection. The tender is six-wheeled, with one pair of wheels in horn-blocks and the other two in a diamond-frame bogie. The following are some of the leading particulars of these engines:

Engine—	
Gauge	4 ft. 8½ in.
Cylinders	22.05 in.x23.62 in.
Valves	9½ in. (piston)
Wheels, driving	63 in.
Wheels, bogie	38.9 in.
Boiler barrel, diameter	62 in.
Fire-box, length	90 in.
Fire-box, width	42¼ in.
Fire-box, thickness	
Side sheet	⅜ in.
Back sheet	5-16 in.
Crown sheet	⅜ in.
Tube sheet	½ in.
Water space, front	4 in.
Water space, sides and back	3 in.
Tubes	1⅞ in. and 5 in.
Tubes, 1⅞ in., number	146
Tubes, 5 in., number	24
Tubes, length	12 ft. 6 in.
Heating surface, fire-box	141 sq. ft.
Heating surface, tubes	1,279 sq. ft.
Heating surface, total	1,420 sq. ft.
Superheating surface	343 sq. ft.
Grate area	26.4 sq. ft.
Working pressure	170 lb. per sq. in.
Wheelbase, driving	12 ft. 6 in.
Wheelbase, engine	24 ft. 9 in.
Weight on coupled wheels	47.8 tons
Weight on bogie	9.7 tons
Total engine weight	57.5 tons
Tender—	
Tank capacity	3,450 U.S. gals.
Fuel capacity	3.5 metric tons
Engine and tender	
Wheelbase, total	45 ft. 2 in.
Weight, total	90 tons

The 4-6-2 engine for China (Fig. 2) is a fairly large one, and is designed to inaugurate a new passenger service of heavy trains on fast schedule. This engine develops a tractive force of 26,800 lbs. (at 85 per cent. boiler pressure), and, as the weight of the driving wheels is 43.15 tons, the adhesive weight is fully utilized. The frames are of the plate type. The fire-box is of steel. A superheater of 24 elements is provided. The fire-door is operated by compressed air. The valve gear is of the Walschaert type, with screw reversing gear. The pistons are of cast steel. The coupled wheels are equalized. Further particulars are given tabulated below. The tenders for these locomotives have been built in the shops of the railway company, from material furnished by the Baldwin Locomotive Works:

Engine—	
Gauge	4 ft. 8½ in.
Cylinders	20 in. x 26 in.
Valves	11 in. (piston)
Wheels, driving	66 in.
Wheels, bogie	37½ in.
Wheels, trailing	43 in.
Boiler barrel, diameter	68 in.
Fire-box, length	90 3-16 in.
Fire-box, width	66¼ in.
Water space, front	4 in.
Water space, side and back	3½ in.
Tubes	2 in. and 5⅜ in.
Tubes, 2 in., number	172
Tubes, 5⅜ in., number	24
Tubes, length	19 ft.
Heating surface, fire-box	146 sq. ft.
Heating surface	2,343 sq. ft.
Heating surface, total	2,489 sq. ft.
Superheating surface	559 sq. ft.
Grate area	41.4 sq. ft.
Working pressure	200 lb. per sq. in.
Wheelbase, driving	11 ft. 8 in.
Wheelbase, [illegible]	31 ft. 9 in.
Weight on coupled wheels	43.15 tons.
Weight, bogie	19 tons
Weight, trailing wheels	14.5 tons
Total engine weight	76.65 tons
Tender—	
Tank capacity	6,000 U.S. gals.
Fuel capacity	8½ tons
Engine and tender—	
Wheelbase total	59 ft. 9 in.
Weight, total	128.12 tons

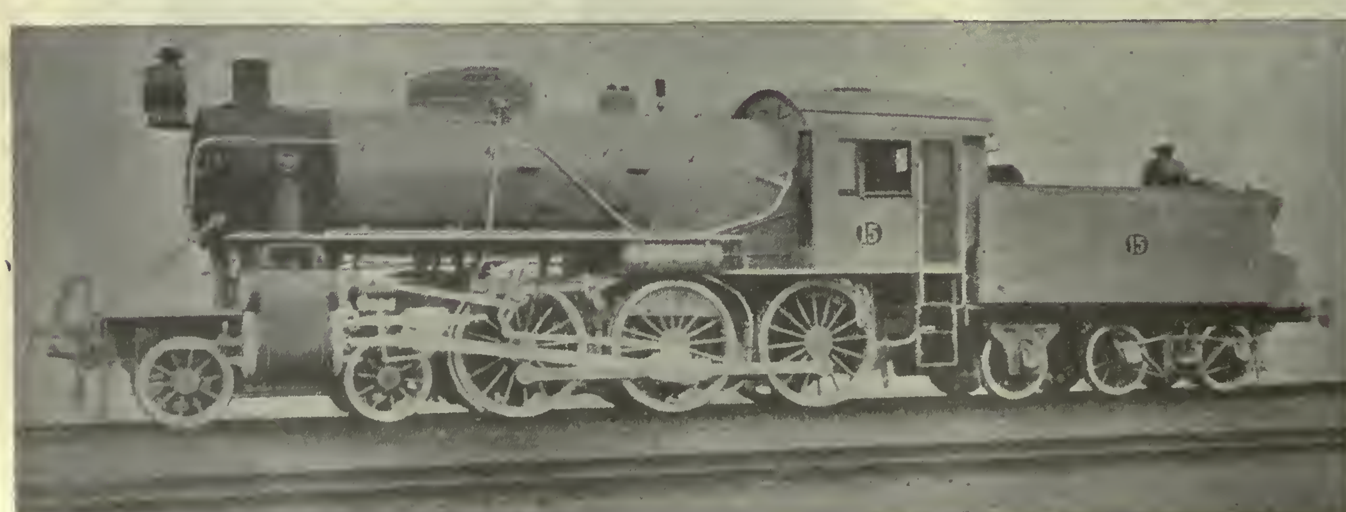


FIG. 1—4-6-0 TYPE SUPERHEATER LOCOMOTIVE FOR THE NOWEGIAN TRUNK RAILWAY.

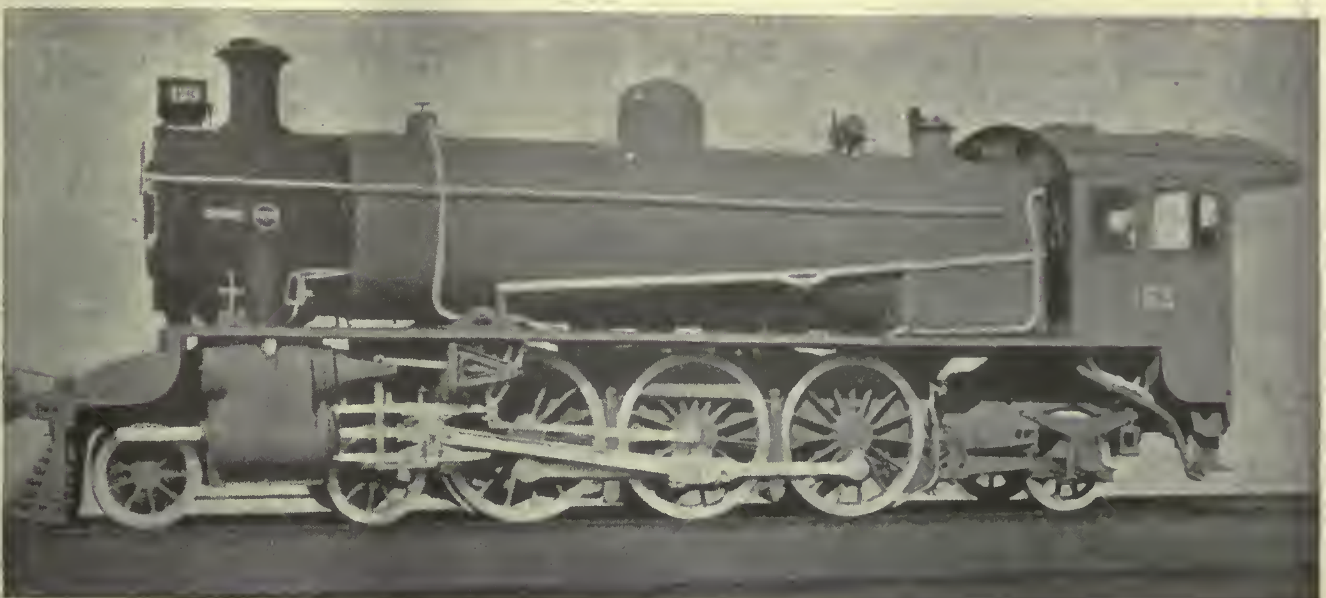


FIG. 2—4-6-2 TYPE LOCOMOTIVE FOR THE PEKING-MUKDEN RAILWAY, CHINA.

How Many Sizes of Shafting Should We Have?

IN ANSWER to the above query, the American Society of Mechanical Engineers recommend that fourteen sizes of transmission shafting be used. The committee of this society devoted to War Industries Readjustment, state that an immense amount of steel is continuously tied up in manufacturers' and dealers' stocks of shafting and that a corresponding amount of cast iron is also held in stock in the form of hangers, bearings, couplings, collars, bushings, pulleys, etc. At the suggestion of the chairman of the committee on War Industries Readjustment, a committee was formed to investigate the subject of the standardization of shafting sizes. The personnel of the committee is as follows: Cloyd M. Chapman, chairman; George N. Van Derhoef, Hunter Morrison, Louis W. Williams, and Russell E. Nelles.

This committee was confronted with two distinct but closely related problems, namely, standardization of the diameters of shafting used for transmission of power, such as lineshafts, countershafts, etc., and the standardization of the diameters of shafting used by machinery manufacturers in making up their product. The first of these problems seemed to be the simpler of the two. While a large number of sizes of transmission shafting are now listed and stocked, it was believed that comparatively few of these are in extensive general use. Accordingly, a letter was sent to thirty-six of the largest manufacturers and dealers in transmission shafting asking for statistics on the consumption of each size of shafting handled by them. About twenty of the largest concerns in the industry furnished complete statements of their sales over periods of time chosen by themselves. These data were reduced by the committee to a uniform basis of percentages. The amount of each size sold was expressed as a percentage of the total sales, both on a weight basis and on a lineal-foot basis. From these data, plotted in the form of a diagram, it was evident which of the sizes were popular and generally used and which were more rarely called for. A tentative list of twelve sizes was prepared from this diagram and sent to forty-six other dealers in transmission shafting and shafting supplies, from whom twenty replies were received.

In the letters to these firms, the committee expressed the opinion that the custom of using shafting 1/16 inch under the unit sizes is so firmly and so nearly universally established in this country, that it would be unwise to attempt to adopt sizes in even inches and fractions as standard. It was pointed out, also, that certain sizes stand out pre-eminently as "popular sizes" and that others are sold in relatively small quantities. It therefore seemed feasible to reduce the number of sizes now listed by the trade from fifty or sixty down to twelve or fifteen.

The response to these letters was practically unanimous in opinion. The transmission shafting users and dealers approved the plan of standardization, and the sizes suggested were generally approved except that the diameters 1 11/16 inches and 2 3/16 inches were in many cases requested to be included. After due consideration the committee decided to include these two sizes in the original list, making the fourteen sizes now adopted as standard.

Shafting Sizes Used in Machine Design

The second problem was a more intricate one. The number of sizes now produced by the rolling mills for use in machinery is very large. Almost every sixty-fourth of every inch up to three inches is drawn. If a reasonable number of these sizes could be eliminated or classed as "specials" and a comparatively few sizes selected as standard or stock sizes, a great saving would be effected. In order to get the opinion of leading consumers of shafting for machinery purposes, the committee decided to lay the plan before 225 large consumers of this material. It was explained that it was not intended that the adoption of certain sizes as standard should make it impossible to secure any other size required on special order.

In the case of machinery shafting the users were equally unanimous in their approval of the plan to standardize sizes, but recommendations as to size intervals varied greatly. However, these recommendations, in so far as they were definite and specific enough, were tabulated and a diagram constructed showing the relative popularity of the various size increments for each inch of diameter.

With these data accumulated and sifted down to usable form, the committee felt that it was in a position to present its information and preliminary deductions to representatives of other interested organizations. Accordingly, invitations were issued to twelve societies and associations requesting them to consider the proposed lists of standard sizes and to appoint representatives to confer with the committee before its report was finally formulated. The seven organizations listed below responded, and the standard sizes which follow have the unanimous approval of these representatives and, as far as can be learned, of their associations: American Hardware Manufacturers' Association; American Railway Engineering Association; American Supply & Machinery Manufacturers' Association; National Association of Manufacturers of U. S. A., National Association of Purchasing

Continued on page 530

Interesting Tool Set-Ups for Turning of Pistons

—By J. H. Moore

IN the production of any kind there are always different methods of accomplishing results. Some swear by some series of operation, while others might be inclined to pooh-pooh the very method adopted and approved by the first enthusiast.

It is this striving after maximum production that is responsible for the modern machine tools that are on the market to-day, and one might add that this struggle after production has been in reality a blessing in disguise, for it has brought out tool equipment of such ingenious construction as to be almost unbelievable.

One field that has benefited considerably is that of concerns turning out pistons of any nature. In the old days the method of producing pistons was to laboriously turn up the product by means of a single tool on an ordinary lathe, Sometimes the lathe was none too good, with the result that the piston was almost round. The fitting of such pistons created splendid amusement (?) for the erecting department. Conditions, however, have changed since those days when anything was good enough, and to-day the demand is not only for speed, but for accuracy.

Believing that readers would be interested in the description of a rapid method of producting pistons, we have secured data on one of the systems used by the Jones & Lamson Machine Co., on their Fay automatic lathe. If not familiar with this style machine, a glance at Fig 1 will give a good idea of its general construction.

The Actual Operations

The main feature in the description to follow is the simplicity of the tooling, the small number of operations, and the performing of the operations automatically wherever possible, thus allowing the use of unskilled labor.

The casting on coming from the foundry is set over a centering mandrel in a sensitive drill press and centre drilled true with the rough core, drill being guided by a bushing. The skirt, or open end of piston, is not finished at this time, as it will only have to be done over again after roughing out, owing to the distortion in "seasoning." It is held succarefully for rough turning, true with the core without holding by the skirt.

The piston should be provided with a large boss as shown, so that a deep, heavy centre can be used. It is a good plan to take heavy cuts and several of them at once, and a small centre hole is not sufficient for such a procedure. The next operation is to mount on expanding and centering air operated mandrel lathe as shown at Fig. 2. The outer end is held in place by air operated tailstock, as shown in photograph at Fig. 1.

In Fig. 2 the three plungers A centre the open end of piston with the core, while the closed end is centered by the dead centre B, drilled true in the first operation. The inner end of the core stops against plug C, giving a uniform thickness of wall to the piston head. Driver D engages the wrist pin lugs and gives a positive drive. The piston is thus centered on the core, stronogly supported and strongly driven by a fast operating air mechanism. One air valve operates both mandrel and tailstock.

The rear tool holder feeds in radially and carries facing tool E, rough ring grooving tools F and oil groove tool G. Tool H faces the open end. The front carries the three turning tools J which feed in to depth on an angle as shown by the arrow and divide the rough training between them.

As many tools J are used as are needed to complete the turning in the time it takes tool E to face the end. In other words the piston is completely roughed out over its entire exterior surface in the time it takes to face the end only. The benefit of this arrangement is self-apparent.

Third Operation

The wrist pin holes are now rough drilled in a jig which centres on the rough turned exterior, stops against the rough faced end, and lines up by the bosses on the inside. This operation completes the removal of the bulk of the material and of the scale.

The next, and fourth operation is that of annealing, for this is the logical time to anneal. With scale and material removed, there is the best possible chance to eliminate all strains and remove every chance for future distortion. It is somewhat objectionable to remove the pistons from the machine department to an outside heat-treating shop, but this may not be necessary. A modern, continuous feeding automatic furnace can be installed in the shop, right in the production line. Suitable heat insulation and forced ventilation will make this arrangement comfortable even in hot weather.

Now comes the proper time to finish face and bore the skirt or open end. With strains removed and stock roughed off there is no danger of further distortion. This skirt finishing is done in an air chuck as shown in Fig. 3. The back arm moves in the direction shown by the arrow, so that tool A first rough bores, then tool B finish faces. The rough facing was done by tool H in Fig. 2. The front carriage carries only the finish boring tool C, unless it is desired to break or bevel the corner, in which case a tool D shown in dotted lines is added for the purpose. At the conclusion of the cut the tools both front and back withdraw, without scoring the work, to a point which leaves plenty of room to remove the work.

In this operation the work is held by the outside diameter and stopped on the face of the closed end. Since these surfaces were made true and of even dimensions with the core in Fig. 2, the finished bore skirt will also be true and of the proper dimensions with the core, and may therefore be used from now on for locating the piston. Being held with the skirt projecting well beyond the jaws, there is no distortion from the chucking.

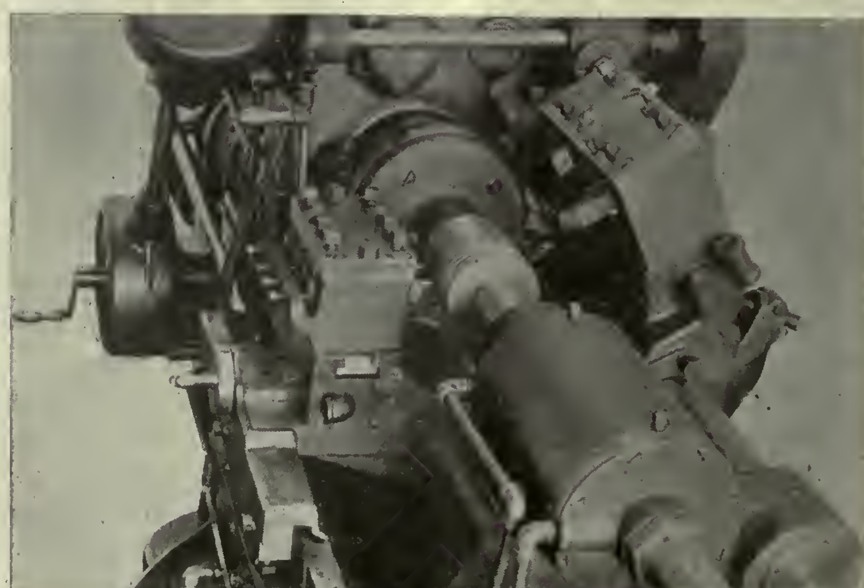


FIG. 1—A VIEW OF MACHINE FROM THE TOP.

Sixth Operation

Finish turning complete comes next. The piston is now seated on a hardened and ground plate on the spindle, and held there by a floating centre in the quick-acting tailstock. The centre has a ball thrust, and is made floating to obviate the necessity for re-centering true with the skirt. This method has been found to be as accurate as holding by draw-rod and loose wrist pin, it avoids the loose piece, and is much more rapid in operation. The drive is by equalizing driver D, engaging the wrist pin lugs. In this operation there are three tool holders, as shown in Fig. 4. The front and back holders are tooled about the same as in Fig. 2. There is an additional grooving attachment carrying tools for grooving the rings. This attachment is strongly supported on the tailstock casting and is operated by the forward movement of the carriages.

In the grooving attachment, tools H give a second roughing cut to the piston grooves. In the rear holder tool A finish faces the end of the piston and tools B finish the ring grooves. In the front carriage tools C, three of them, finish turn ready for final grinding. It will be noticed that with this arrangement the ring grooves are given three cuts in all, permitting great accuracy in the finished surfaces. The complete finish turning, grooving and facing operations are also completed in the time it takes to face down the end only. The ring grooves, as will be noted, are finished on centres, eliminating all end play of spindle. This of course goes to produce a perfect gas seal, making it entirely unnecessary to go to the engine lathe for a final grooving operation.

The piston next has the wrist pin holes finished and then goes to the drill press for miscellaneous drilling of oil holes, etc. The centre boss is next sawed off in a hand mill, and finished off on a disk grinder. Some firms remove it entirely by disk grinding. It is now ready for the final grinding, which is done on a face plate, holding by the draw-rod and a loose wrist pin. This operation being completed, the piston is ready for the rings to be fitted.

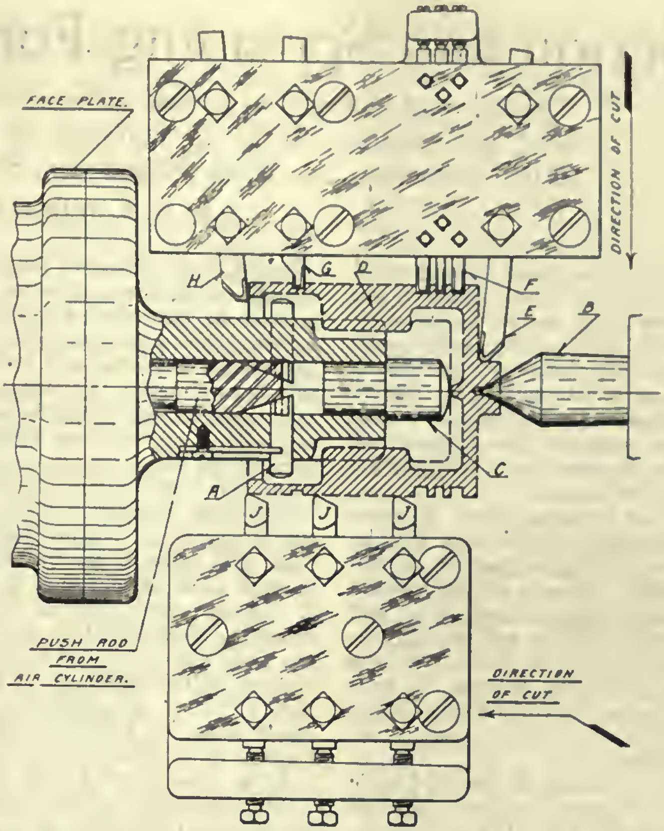


FIG. 2—FACING, ROUGH GROOVE, AND OIL GROOVING OPERATION.

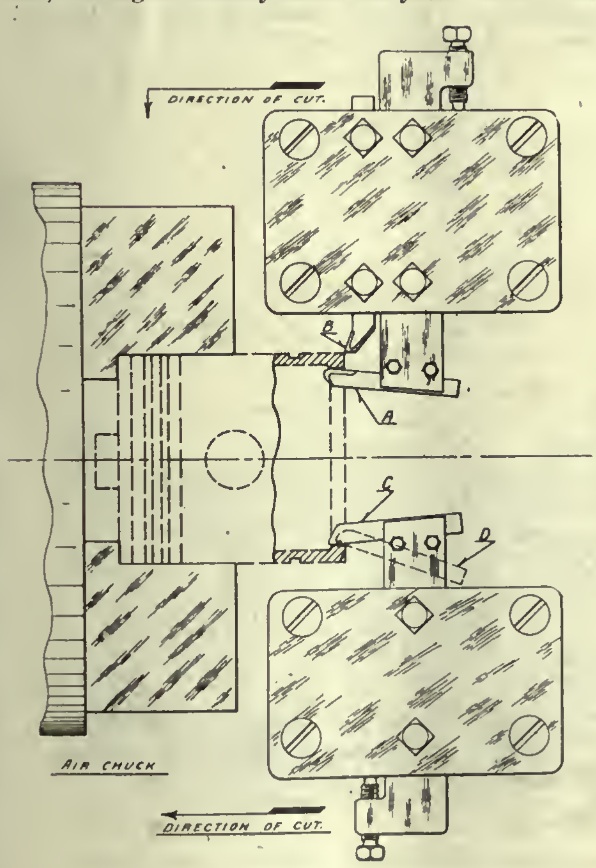


FIG. 3—THE SKIRT FINISHING OPERATION.

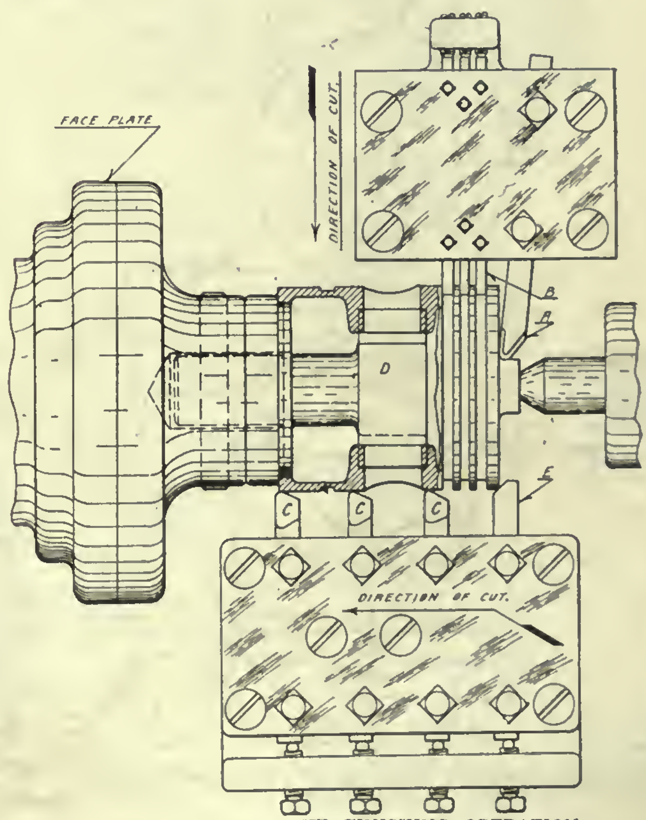


FIG. 4—THE FINISHING OPERATION.

Friction and Spreading Forces in Rolling Mills

The Subject of Friction Losses Is One of Considerable Importance and the Author, Who Is Director of the Bureau of Rolling Mill Research, Is Well Fitted to Speak on This Question.

By W. B. SKINKLE

THE need of accurate knowledge of the forces acting on rolls and the friction losses on roll necks in different types of rolling mills has prompted the author to respond to the editor's request for an article with a description of a device soon to be tried out on the experimental mills of the Bureau of Rolling Mill Research at the Carnegie Institute of Technology.

By means of this equipment it is expected that experimental data will be secured which will give positive, accurate knowledge, not only of the relative values of the various lubricants and bearing metals used on roll necks, also of the spreading forces acting on the rolls; from which the stresses in rolls and housings may be calculated to a far greater degree of accuracy than is at present possible.

The device consists of two hydraulic supporting cylinders marked Cylinder No. 1 and Cylinder No. 2 in Figs. 1 and 2, located in the bottom of the roll-housing window and so arranged that they can easily be removed and replaced by a filler.

The carrier for the bottom roll rests on the plungers of these cylinders in such a manner that the forces acting on the roll neck are recorded by the resulting hydrostatic pressure in these cylinders.

In Fig. 1 is a diagram showing the arrangement of these cylinders and their relation to the rolls. A bloom is shown between the upper and lower rolls with the lower roll carrier and cylinders. The full lines indicate the position of this carrier under static conditions (condition of rest). The conditions existing at the neck of the lower roll are greatly exaggerated for the purpose of illustration.

The total spreading force F, due to the bloom being pinched between the rolls, will cause a heavy force P to be applied about as indicated in Figs. 1 and 2. Under static conditions this force would be transmitted from the body to the neck and would be applied to the bearing as indicated by the arrow A in Fig. 1. Such an application of forces would cause one-half the load P on each bearing to be carried by cylinder No. 1 and the other half by cylinder No. 2.

The proportion of the total force F which is distributed to each neck of the rolls will depend on the location of the pass in the roll body and can readily be figured by the well-known principles of beam reactions.

Where rotation starts, and the bloom is being rolled, the point of contact between roll neck and bearing changes to some other point, the force P is then applied to the bearing as indicated by the dotted arrow B, and the lower roll carrier has a tendency to assume a position indicated by the dotted lines, using the roller C as a fulcrum point; the roller D lifting off its seat. The position indicated by these dotted lines in Fig. 1 of course is greatly exaggerated for the purpose of illustration. It is vitally important, however, that the bearing be perfectly free to rotate as indicated, and that no forces other than cylinders Nos. 1 and 2 be interposed to prevent this rotating tendency. (In actual practice it is expected that not more than 0.003 in. or 0.004 in. of movement will be obtained on these cylinders between no load and their maximum carrying capacity of 250,000 lb. each).

When the contact point has moved to a place where it slides back as rapidly as it tends to climb, the angle of sliding friction has been reached and a condition of equilibrium is again established. These conditions are shown and analyzed in Fig. 2. The pressures on the supporting cylinders will no longer be equally distributed, as in the case of static conditions, but will be much heavier on cylinder No. 1 than on cylinder No. 2.

Analysis of Conditions.

In the analysis of these conditions the following symbols will be used:

P=Total resultant force on the roll necks in pounds.

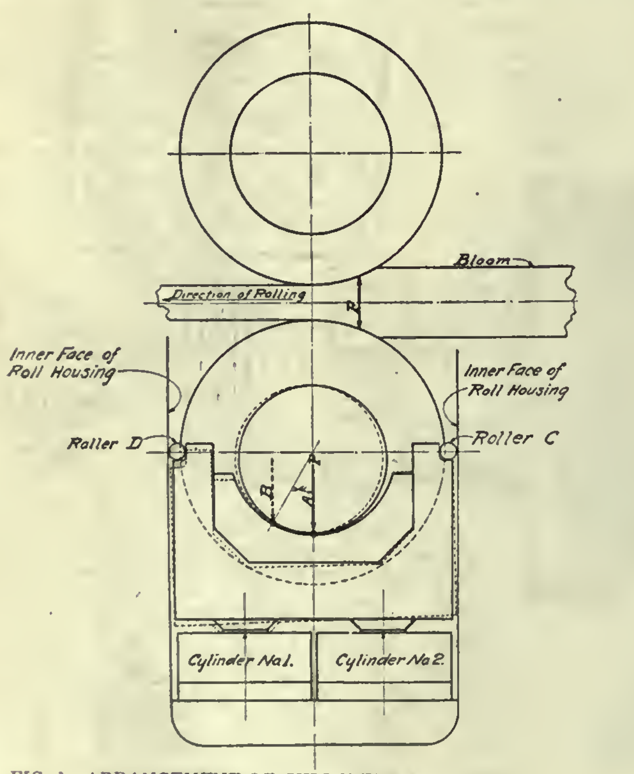


FIG. 1—ARRANGEMENT OF CYLINDERS AND THEIR RELATION TO THE ROLLS.

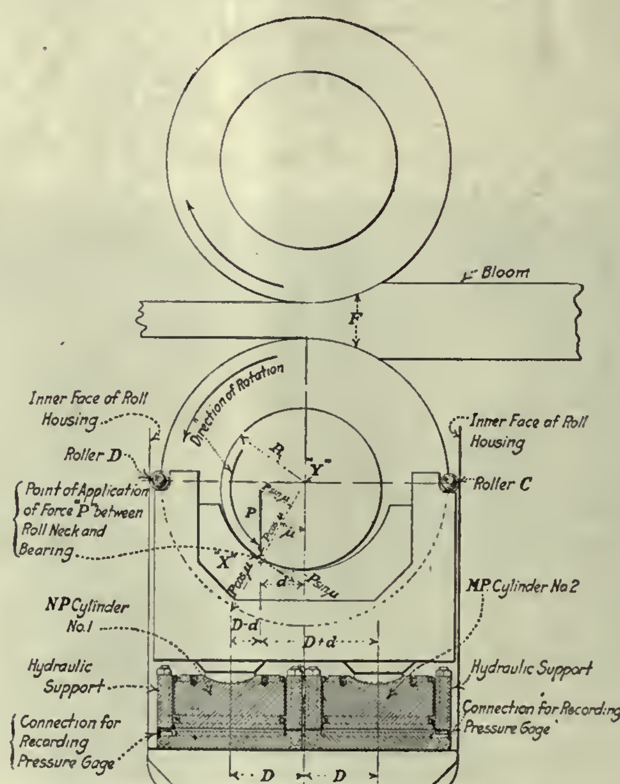


FIG. 2—DIAGRAM OF FORCES EXERTED DURING ROTATION.

R=Radius of the roll neck in inches.

U=The angle whose tangent is the coefficient of friction.

D=Distance from centre line of roll housing to centre line of supporting cylinder.

d=Distance from centre line of roll-neck bearing to the point of contact between the neck and bearing.

N=Some fraction of P greater than ½.

M=Some fraction of P less than ½.

If equilibrium in a "free body" is maintained the following conditions must be met:

1. The sum of all horizontal or vertical forces acting on the body must be equal to zero.

2. The sum of the moments of all forces acting on the body taken about any point must equal zero.

Fulfilling the first condition, as applied to the vertical forces on the lower roll neck bearing, we have $-P+N\,P+M\,P=0$, whence $N\,P+M\,P=P$. Cancelling the P's we have

$$N+M=1$$

This shows that for each increase for over half the total load carried by cylinder No. 1 there is a corresponding decrease in the load carried by cylinder No. 2 and that the sum of the pressures on cylinders Nos. 1 and 2 must be equal to the force P. This same fact can be shown by taking moments about the point x where the roll neck applies its load to the bearing. In this case the force P has no lever arm. Its moment would therefore be zero, and it may be neglected. Taking moments about x we have

$$+N\,P\,(D-d)-M\,P\,(D+d)=0$$

which expands into

$$N\,P\,D-N\,P\,d-M\,P\,D-M\,P\,d=0 \ldots [1]$$

Taking moments about Y the centre of the roll neck we have

$$-P\,d+N\,P\,D-M\,P\,D=0 \ldots\ldots\ldots [2]$$

The foregoing is true only if the hydraulic support cylinders are frictionless. If these hydraulic cylinders were of the ordinary hemp-packed plunger type the results obtained would be almost useless as the friction of the packing on the plunger would be very large and the exact amount of this friction would be very difficult if not impossible to determine.

It will therefore be necessary to produce a frictionless hydraulic support cylinder. This, the author believes, has been practically obtained in the cylinder shown in Fig. 3. While it is recognized that no machine can be absolutely frictionless, this cylinder so nearly approaches this ideal state that for all practical purposes it may be considered as frictionless.

The cylinder consists of an upper guide cylinder A securely bolted to its base B by sixteen ¾-in. bolts G. The base, which is really the cylinder proper, has a groove 9¼ in. inside diameter cut into it. The centre portion of the base is then faced off to allow just a film of fluid not over 1-16 in. in thickness to act on a special stretched-steel diaphragm C, which is securely held in place by the friction between the parts A and B of the cylinder and is made tight on its lower side by a soft lead gasket. By this means the fluid is completely confined in the cylinder, the only escape being through the orifice leading to the recording pressure gage. The plunger D does not come in contact with the fluid in the cylinder but rests on the upper side of the steel diaphragm C. These contacting surfaces must be very flat and true.

In order to avoid friction between the plunger D and the side walls of the guide cylinder A the plunger is turned ⅛ in. smaller in diameter than the guide cylinder on its upper parts, and 0.005 in. smaller in diameter where it rests on the diaphragm.

In order to prevent lost motion or the plunger from tilting and shearing the diaphragm, and further to prevent the plunger from getting "off centre" and having a rubbing contact with the cylinder walls, two rings of fifty-six ½ in. diameter steel balls each, marked F, are provided.

The inside diameter of the guide cylinder A is ground to as nearly a perfect circle as possible and the grooves for the balls are ground and polished to an accurate fit.

When the plunger moves downward due to the application of a load these steel balls tend to lift off their seats and establish a rolling contact between the plunger and cylinder walls.

The only friction on this cylinder is the friction of these ball-bearings, the internal friction of the steel in the diaphragm and the friction of the fluid in the pipes leadng to their recording gages. These quantities are so small when compared with the maximum load of 250,000 lb. which each cylinder is designed to carry, that they may be neglected.

The displacement of fluid by the plunger when under load is equally small. Marks' Mechanical Engineers' Handbook, page 251, gives the following information: "A pressure of 1 lb. per sq. in. compresses liquids in volume as fol-

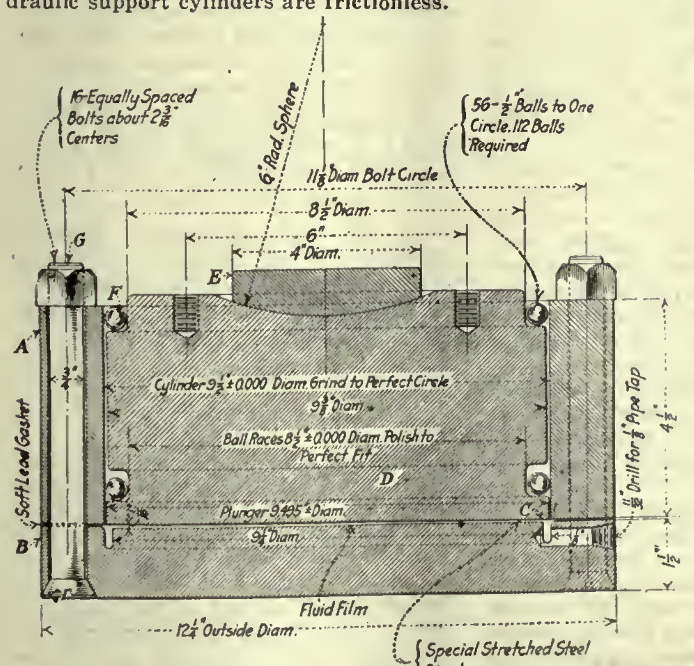


FIG. 3—DETAILS OF FRICTIONLESS HYDRAULIC SUPPORT CYLINDER

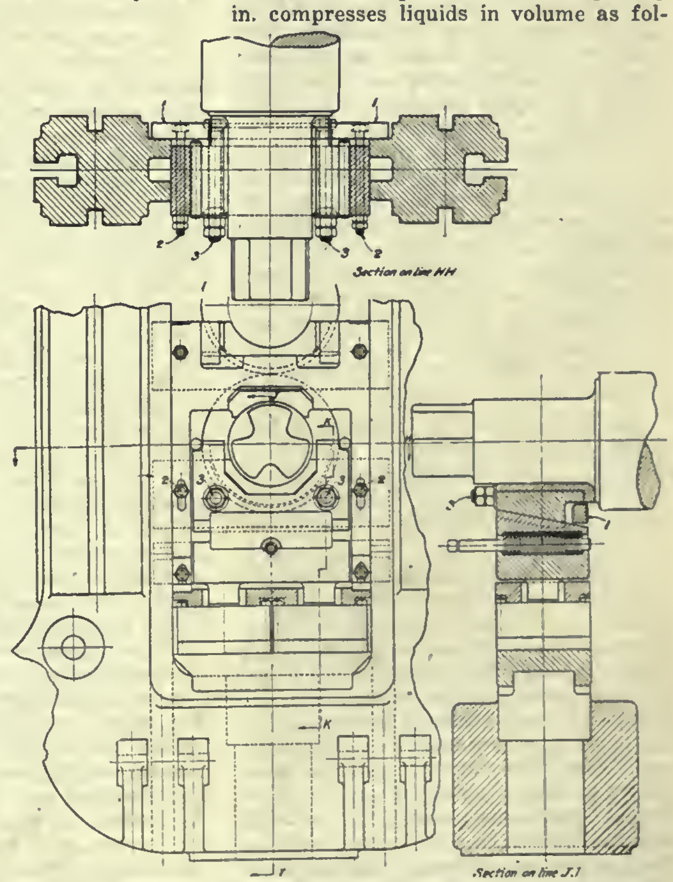


FIG. 4—DETAILS OF MILL SHOWING BOLT WITH BALL JOINT TO PROVIDE FLEXIBLE CONNECTION BETWEEN THRUST PLATE AND LOWER ROLL CARRIER.

lows: Water 1 part in 300,000; mercury 1 part in about 4,700,000. For water in an iron pipe this corresponds to a compression of 2 in. per mile of length for a pressure of 10 lb. per sq. in."

It will easily be seen that such a compression of the fluid will not disturb the roll setting. The only other factors entering into the plunger displacement are the quantity of fluid necessary to move the needles of the recording gages and the expansion of the short pipes leading to these gages. Both of these factors are so small that they may be neglected.

The idea of this frictionless diaphragm cylinder is not new, but has had several stages in its development. It appears to have been originally invented by Mr. Emery, who first applied it to the well-known testing machine bearing his name. The general application of this invention was delayed by the fact that Mr. Emery measured the pressure in his hydraulic supports by means of a complicated balancing and weighing mechanism. The hydraulic support was made accessible to general use by the research work of Dr. A. Martens at the German Government materials-testing station, who measured the pressure in the hydraulic support by means of Bourdon pressure gages and who proved conclusively that the combination of hydraulic support and pressure gages forms the most accurate and desirable means for measuring without friction or lost motion, forces of any magnitude and of any suddenness of application.

Prof. W. Trinks, head of the department of mechanical engineering at the Carnegie Institute of Technology, first conceived the idea of applying cylinders of this type to roll necks sometime early in 1916, and made drawings of a special roll housing for this purpose.

When the author was placed in charge of the organization of the Bureau of Rolling Mill Research and of the designs of the experimental mill he carried the development one step further by designing the present cylinders in such a manner that they would fit in the window of an ordinary roll or pinion housing, and could easily be replaced by a filler casting in case experiments not requiring their use were to be made.

The first cylinder of this type is now in the course of construction and will be carefully tested and calibrated under a 600,000-lb. compression testing machine before the final design is produced for the experimental mill.

Diaphragms varying in thickness from 1-64 in. to 3-64 in. are on hand and their relative merits together with the relative merits of mercury or water for the fluid will be carefully investigated before the final selections are made.

Fig. 4 shows these cylinders applied to the 18 in. three-high bar mill, which are somewhat different from those shown in Figs. 1 and 2. These last-mentioned figures were taken from the 24-in. sheet mill with the neck brass "faked in" for the purpose of better illustration of the mechanical principles involved.

There is one more important item which should be considered before bringing this article to a close. That is the friction of the end of the roll-neck brass on the roll body.

The "thrust plate" marked "1" in Fig. 4 is held firmly against the inside of the roll housing by bolts 2 and 3 and, unless a flexible connection between the lower roll carrier and this thrust plate were provided, would offer a very substantial resisting force acting against the rotating tendency of the lower roll carrier.

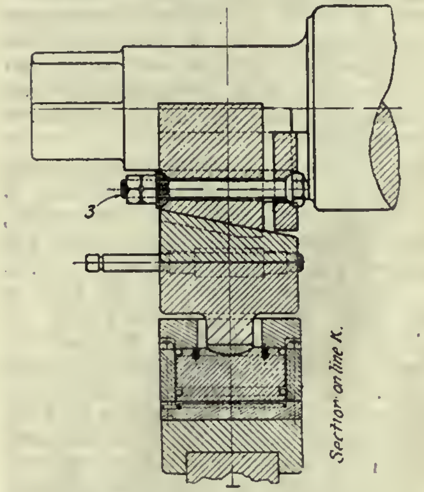


FIG. 5—DETAILS OF BOLT SHOWN AT FIG. 4.

To overcome this bolts 3 are made with ball joints at their inner and outer ends. In this manner any retarding action due to the stationary thrust plate is avoided. Fig. 5 is a section through this bolt and clearly shows the construction.

The importance of careful experiments on roll-neck friction will be realized when it is stated that, according to the best information at present available, between 40 and 50 per cent. of the total work of a blooming or bar-mill engine is absorbed in friction on the roll necks. These figures represent the best working conditions in roll-mill practice. For mills such as plate, skelp or sheet mills rolling wide, thin sections, which are often cold, the work lost in friction on the roll necks is frequently between 70 per cent. and 80 per cent. of the total work of the engine or motor.

The designs of the experimental mills are being worked out with extreme care, which of necessity involves a slow rate of progress. They offer a great many problems similar t othe one just described. It is expected that these designs will be completed during the next three or four months and will be given to the public very shortly thereafter.

The Carnegie Institute of Technology is throwing open to the members of the Bureau nearly $400,000 worth of building and equipment, free of all charges for rentals, etc. More than half of the money necessary to add this experimental rolling mill has already been definitely subscribed and the remainder is in sight. The completion of this experimental mill will make the Bureau of Rolling Mill Research what is probably the largest and most complete steel research laboratory in the world.

SIZES OF SHAFTING

Continued from page 525

Agents; National Machine Tool Builders Association; and Southern Supply & Machinery Dealers' Association.

Report on Shafting Sizes

On January 14 the committee submitted to the council a report in which it recommended the approval and adoption of the following lists of sizes as standard for the society:

Transmission Shafting—15/16, 1 3/16, 1 7/16, 1 11/16, 1 15/16, 2 3/16, 2 7/16, 2 15/16, 3 7/16, 3 15/16, 4 7/16, 4 15/16, 5 7/16, and 5 15/16 inches.

Machinery Shafting—Size intervals extending to 2½ inches, by sixteenth inches; from 2½ to 4 inches inclusive, by eight inches; and from 4 to 5 inches by quarter inches. The council approved the report and accepted the recommendations.

Extend Working Day.—Canada Foundries and Forgings, Limited, announce that their Canadian Billings and Spencer plant at Welland, after two weeks shut down on acount of strike, has once more resumed operations in full; the Employees having agreed to the company's terms, which include an extension of the working day from an eight to nine hour basis.

Interesting Facts Regarding Molybdenum

IN the new steel invented by Dr. J. O. Arnold, 6 per cent. of molybdenum is substituted for 18 per cent. of tungsten. Dr. Arnold's discovery followed up his previous invention of vanadium steel—the best high-speed steel, which contains roughly 6 per cent. of carbon, 18 per cent. of tungsten, and, say, 3½ per cent. of chromium. The result of the substitution of molybdenum for tungsten was that he produced exactly the same steel with one-third of the amount of the most expensive element, and got equal, if not better results—say a 10 per cent. better result. The importance of this from the point of view of the cost of the steel is manifest.

A representative of "The London Times" has had a conversation on the subject of Dr. Arnold's new steel with Mr. Alexander J. McConnell, who, during the period of the war mission in America, was director of raw metals purchases for the mission in the United States and personal adviser of His Majesty's Government on sources of supply of molybdenum and molybdenite ore. Captain George Sykes, who was present at the interview, was the director of purchases of aeronautical parts for the British War Mission in America.

Mr. McConnell, who was sent to America in December, 1916, by the Minister of Munitions, said he noticed that Dr. Arnold, in his references to the discovery, confined himself to the steel-hardening qualities of molybdenum, and to that extent endorsed the value of molybdenum, in a way that every high-speed steel tool-maker would appreciate. But if Dr. Arnold stopped there, then he thought it would be known that the United States had gone far beyond us in advocating molybdenum as the most valuable alloy, probably, that has ever come under the attention of the steel industry. At this moment the great Fifth Avenue Omnibus Company, of the city of New York, is using exclusively springs made of molybdenum steel. In the opinion of Captain Sykes, molybdenum gives steel springs greater dynamic and impact value over chrome vanadium steel springs, which had previously been the standard springs of the steel trade. It is significant, added Mr. McConnell, that a number of the largest alloy steel manufacturers in the United States—among them the Crucible Steel Company, the United Alloy Steel Corporation, and the Carbon Steel Company—are now unreservedly advocating the use of molybdenum in steel because it is the toughest and strongest thus far developed in the alloy steel industry.

Dr. Arnold has, probably, only published the results of his researches, so far as a man of his distinction in his profession would commit himself to, but he is very likely aware, said Mr. McConnell, of the value of molybdenum beyond its steel-hardening qualities. The United States contemporaries of Dr. Arnold pronounce molybdenum steel as: (1) Combining lightness with strength; (2) lending itself to easier machining with a much wider range of heat treatment; (3 possessing a greater tensile strength and a greater elongation, with a higher dynamic and impact value. In short, the Americans are adopting a slogan regarding molybdenum steel to the words "lightness with strength." An important economic aspect of recent developments in the use of molybdenum, interpolated Captain Sykes, was that the steel can now be produced in a basic open hearth furnace, as against the previous limitation of an electric furnace. Captain Sykes also committed himself to the considered opinion that the future of our motor-car industry is wrapped up in the use of molybdenum steel, his own experience being that in axles, cranks, shafts, connecting rods, cam shafts, transmission and differential gears, roller bearings, ball bearings, and other fitments, this steel gives a result that has never hitherto been reached by any other alloy steel.

Mr. McConnell, continuing, said it would probably be found that scientific men have been working along similar lines without ever having been in consultation, meeting the same difficulties together and having the same proportion of success. It would, however, be a calamity if proprietary rights were established over the manufacture of a form of steel essential to the general engineering and manufacturing business of our country; and nothing, he imagined, was further from Dr. Arnold's purpose.

To the English steel maker the problem was: "Can I obtain an adequate and regular supply of molybdenum at a fair price and be protected over a period of years against being 'caught short' in such an essential element?" It should not be beyond the ability of our country to have a call upon a sufficient proportion of the world's supply of molybdenum to put our steel industries outside the range of anxiety in the matter of supplies. If this problem is overcome, as Mr. McConnell is convinced it can be, then British steel makers need have no fear of holding their own in quality against all competitors, but promptitude in finding sources of supply of molybdenum is absolutely imperative. The largest and the most consistent of the ore deposits on the American continent are at Climax, in the state of Colorado. There are pockety formations in other states and in the Dominion of Canada, particularly in the province of Quebec, but the Climax molybdenum deposits are the most extensive. They are at an altitude in the Rocky Mountains of no less than 14.000 feet above the sea level, and it was formerly thought they could only be worked during a limited period of the year. By a process of tunneling, however, and by great engineering skill the deposits are now capable of being drawn upon for regular production.

Mr. McConnell's practical advice to the steel-makers of this country is: "Secure your supplies of molybdenum from a strong producing company that will guarantee delivery, and whose contractual obligations can be absolutely relied upon."

Following is a record from the United States patent office regarding the patent grant to Charles Harold Wells, Detroit.

"It is the purpose of my present invention to provide a commercial alloy steel which at the same time has the super-excellent qualities of certain of the special steels, and retains all of the other characteristics necessary to bring the productive qualities of their ma- per cent. to 1 per cent. or a little higher. the steel within the commercial class; these desired results being obtained at a great saving in cost and reduction in losses, as will appear.

"I accomplish the foregoing by the use of molybdenum, as an added element to alloy steels, in fractional percentages, ranging substantially from between 0 I am aware that molybdenum has been used in what is known as molybdenum high-speed steel, to give such steels increased toughness and hardness, and other good tool-working qualities. Such steels are, of course, impractical for commercial purposes, and their field of use strictly limited. The percentage of molybdenum used in such steel is also quite high, and the steel has not met with extended use because of certain defects which develop. Relatively high percentages of molybdenum have also been used in the production of magnet steels, and in other special steels such as armor plate. big gun steel, and the like. mainly for the purpose of replacing a portion of the tungsten, and that extensive experiments have been made to observe the effect of molybdenum on iron. In so far as I am aware, however, no one has made use of molybdenum in the production of commercial steels to obtain the results and advantages herein set forth; this probably because the experiments of early investigators, of the effect of molybdenum on steels in the normal state led to certain conclusions indicating the presence of questionable properties from a commercial standpoint. I have found, however, that the molybdenum commercial steels, upon being heat treated, apparently do not follow the laws of metallurgy, and that results are obtained opposite in character to those which would be naturally predicted from the steel in the normal state.

"By the use of molybdenum in alloy steels, in small percentages. I find. in so far as the manufacture of the steel is concerned, that all the requirements are well met, and that. in addition to molybdenum does not segregate and apparently has a tendency to prevent segregation

Continued on page 102

WELDING AND CUTTING

Lessons on the A.B.C. of Good Welding

The Effect of Alloys in Steels Is Taken Up in This the Fifth Lesson.

By W. B. PERDUE*

THREE things are important in the welding of steel: First, that the metal added must be similar in its analysis to the original metal; second, that none of the essential physical characteristics of the original metal shall be destroyed by the execution of the weld; and third, that the grain of the weld shall be equally fine as the original section welded.

In the former times the welder gave little thought to the production of a weld having the same strength as the parts welded, and this matter was often passed over with the remark, "The metal you put in the weld is in a cast condition, you can not make it any stronger than a casting." However, by the use of selected material and proper manipulation of the torch and rod welds are being produced by the acetylene process equal in tensile strength to the finest of steel. It seems logical to believe that repetition of the same processes will produce similar results. In fact, certain welders are meeting with such success in this particular line that those who are unable to attain similar successes are forced to admit either the inferiority of their knowledge of such matters or the inferiority of their equipment.

It may be well to remember that the old practice of blaming all troubles on the torch is not a very good one. We do not use fluxes in welding steels except, in some cases, to prevent surface oxidation. Vigorous manipulation of the added material is therefore necessary, both to produce a fine grain and to remove impurities. Regulators must be given the attention and care outlined in a previous chapter and the torch kept in the same good condition in which it was delivered by the manufacturer. Accumulations which form within the bore of the welding tips—the more especially those not made of pure red copper—must be carefully removed in such manner as to leave no ragged or scarred surfaces within. This can not be done by means of a brass or copper wire as many have suggested; but must be done with a steel broach or drill of proper size carefully handled; inserted if possible from the rear end of the tip. This leaves a smooth surface and does not cause the accumulations to cut the metal of the tip.

Welding Steel

Right here it may be stated that any welding equipment which does not deliver a stabilized mixture of stirred gases to the welding flame is unsuited for use in welding steel or any other metal. Impurities in the form of unburned gases driven through the welding cone are particularly harmful. Knowing this, and knowing the deficiencies of their equipment, many manufacturers have been strong in their recommendations of charcoal or electrolytic irons for welding rods to be used in welding steels. The words Norway or Swedish iron applied to such rods do not necessarily mean that these products are imported. In fact, American products are made which excel by far any imported article which can be procured. These terms merely apply to the process of producing iron with a minimum of impurities such as sulphur and phosphorus.

Steel may be defined as iron alloyed with carbon. Pure iron has a tensile strength of from 40,000 to 60,000 pounds per square inch. Steel with a few tenths of one per cent. of carbon has a much greater tensile strength, which with a carbon content of 1 per cent. may be in excess of 125,000 pounds.

Strength Increased

The old idea of the use of a wrought iron rod for the execution of welds in steel was that the absorption of carbon from the impurities passed through the welding flame would change the iron into a steel and thus increase the tensile strength in the weld. Those who advanced this theory seemed to forget that in so doing these impurities also united with the melted edges of the steel which already contain the required amount of carbon. By charging these edges of the weld with an excess of carbon they produce a brittle structure, the result being that when strains come upon the parts a new break develops parallel with and close to the weld. This is because the carbon deposited by the torch is present as an impurity, and does not form a true alloy with the metal in the weld.

Not only does the unburned carbon forced through the welding flame have an injurious effect, but that of the excess oxygen is even more pronounced. When heated to redness steels or irons oxidize quite rapidly unless protected from contact with the surrounding air by means such as the oxygen-consuming envelope of the properly adjusted welding torch.

The surface of the metal in a weld

*Director Welding Dept., Heald's Engineering School, San Francisco, Cal.

NOTE.—Cut accompanying this chapter should have been shown with lesson three.

that is being executed in a proper manner will, therefore, be free from scale and of a beautiful silvery color. It may well be repeated that the presence of bubbles beneath the surface of the melted metal indicates the absorption of gases which may be quite common where excess carbon is driven into the weld. Frothing or foaming indicates oxidation. The ill effects of this foaming may to some extent be reduced by vigorous manipuiation of the welding rod.

To Unversed Operators.

To the operator unversed in the different alloys of steel the author recommends the purchase of a small quantity of each kind of welding rod or samples which should be kept separated and properly labelled. Judgment should be passed on the grade of steel before grinding; the color of the sparks given off in grinding should be noted, after which as a check upon his judgment the end of the supposed similar rod should be ground and comparison made with the characteristics of the spark given off by the article to be welded.

With this precaution and the further precaution to keep a considerable area of metal sufficiently heated to prevent sudden changes in the vicinity of the weld, the student should be able in a very short time to execute dependable welds in almost any finished grade of alloy steels.

In this connection it should not be forgotten that many of these steels are produced in their finished state by means of careful heat treatment, and that after the execution of the weld the entire piece must be properly heat-treated if the weld is such that it must be of exactly the same physical nature of the parts welded. Tests must be frequently applied to specimen welds made for that purpose. A dozen jobs successfully executed will not rebuild the reputation injured by one failure.

An increase in the carbon content of steels diminishes its ductility and malleability; whereas, on the contrary, the tensile strength, elastic limit, and the hardness produced by tempering are rapidly increased. Certain other alloys are used for other and specific reasons.

Vanadium

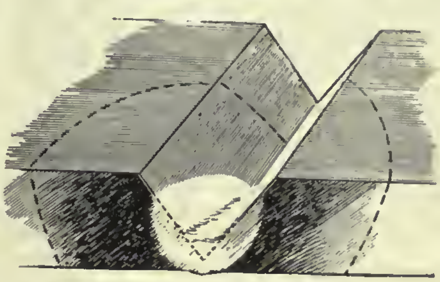
Vanadium added to steel increases the elastic limit and tensile strength, the former mare than the latter. It is used as an alloy where great strength, resistance to vibration, impact and torsional strains and stresses are needed. It tends to make the grain of the metal finer and to raise the tempering point of the metal higher than that of straight carbon steel. In this connection it must be borne in mind that no alloy steel should be tempered with the latent or dying heat produced by welding, but that the piece must be re-heated for tempering.

One of its advantages is that it does not render the steel more sensitive to prolonged high heat. This is contrary to what might be expected from the pearlitic nature of the alloy. In welding, vanadium acts as a deoxidizing and denitrifying agent, thus tending to eliminate impurities from the vicinity of the weld. This action will often be accompanied by a scum of decided oily appearance on the surface of the melted metal. In all cases vigorous manipulation of the rod is necessary, and extreme care is necessary to prevent the formation of adhesions by reason of insufficient fusion of the edges of the weld.

The importance of a vanadium alloy for welding if often over-emphasized, and it should by no means be adopted as a "cure-all" for the welding of all grades of alloy steels.

Nickel

Nickel is added to steel as an alloy to give increased strength and greater



toughness than is found in ordinary carbon steels. In welding this alloy care must be taken to avoid abruptly heating one part while another adjoining portion is at comparatively low temperature. It has a natural tendency to assume a laminated structure and seams may be produced in the weld or its vicinity by lack of caution in this particular respect.

One particular misfortune in the welding of nickel alloys is the apparent ease with which the molten parts flow together. The metal as originally manufactured had very great shock-resisting tendencies, and its ability to resist the stresses is greatly enhanced. Hence the failures, and in many cases serious accidents, which may result from defects in the welds many months after their execution. Shock tests, rather than tensile or bending strains, should be used as tests of welds in nickel steels. Etching by means of an iodine solution composed of iodine 1 part, potassium iodide 2 parts, and distilled water 10 parts, will be found particularly useful.

Care Necessary

In the preparation of surface for this test extreme care is necessary to secure a perfect polish, which after being finished with a "dead smooth" file should be further polished with the finest emery paper that can be procured. The surfaces should not be allowed to touch the hands or any other substance that may import oils or greases. The etching solution should be applied with a brush and washed off in running water 10 minutes after its application. If desired to make a microscopic examination at some later date a coat of transparent varnish may be applied.

Other alloy steels, less frequently encountered, are those of chromium and manganese. A special study of these metals is now being made by the author and the results of his investigation will be given out at a later date. This article will also contain the results of his investigations in overcoming the ill-effects of phosphorus and sulphur.

Mild steels, such as are used in ordinary stetel plate, do not require ether than a mild steel rod of the best grade procurable. The conscientious welder, with a good torch and reliable regulators at his service, who once makes an exhaustive study of the advantages derived frcm the selection of steel frillers of the proper sort to execute a perfectly homogeneous weld will never return to the cld hit or miss practice of using an iron filler.

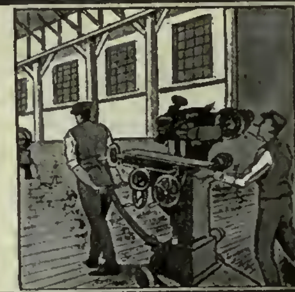
The subject of alloy steels merits consideration and study, and the author respectfully invites other welders to tell him of their experiences along this particular line. Such communications may be addressed in care of this magazine, or to his address at 1220 Post Street, San Francisco.

ACID-RESISTING LEAD AND COPPER

In a paper read before the London Section of the Society of Chemical Industry by Mr. C. E. Barrs attention is directed to the influence of minute proportions of copper alloyed with lead. Where lead is to be used for the concentration pans of sulphuric acid it has generally been assumed that the maximum possible purity of the lead was desirable, though it has been frequently conceded that a small percentage of copper might be admissible, and even advantageous. According to Mr. Barrs' investigations, a lead containing 0.002% of copper, and otherwise practically pure, was vigorously attacked by sulphuric acid at 250 deg. C. (482 deg. F.), whereas an otherwise similar lead carrying 0.021 of copper resisted the action of the acid until a temperature of 296 deg. C. (569 deg. F.) was reached. Generally, it appeared that small percentages of copper, silver, and arsenic increased the acid-resisting power of the lead, while the effect of bismuth and sulphur was to lower it, the influence of antimony being negligible.

The welding of locomotive cylinders has become a regular operation in American railway shops. A paper by a foreman of a Pennsylvania railroad claims that hardly any discovery has meant so much to the railways in the way of economy as the various methods of welding broken or defective cylinder and other castings. The question arises as to the cost of such work as compared with a new cylinder, and it is estimated that for an ordinary weld with acetylene the cost may range from $50 to $175.

DEVELOPMENTS IN SHOP EQUIPMENT



HOB GRINDER

The H. F. Harris Engineering Co., Bridgeport, Conn., have placed on the market what is to be known as their No. 815B automatic hob grinding machine. The function of this machine is to grind hobs with any number of flutes up to 26 flutes, and not exceeding 8 inches in diameter and 10 inches in length. It makes no difference whether the flutes are straight or spiral (helical), both right and left hand spirals are taken care of, without changing gears, by a ball crank handle, shown to the left of the machine, which controls a very fine adjustment through worm, gear, pinion and sector to the forming slide, which is coupled to the work spindle in such a way as to rotate the hob the required amount to obtain the desired amount of helical movement during the longitudinal movement of the work table. This adjustment can be made while the machine is running, as well as when at rest, and the graduated dial, with thirty divisions, reads to half minutes, one complete turn of the ball crank handle equalling ½ degree.

Although no changing of gears are required, it is necessary to change the index plate, putting on one having the same number of notches as there are flutes in the hob. The index plate is readily accessible by removing or lifting off the cover over the index head. This is very simply changed by loosening a knurled nut and taking off index plate, replacing it with another. The indexing is done automatically, and is always done in the same position of the work table, no matter what the length of the hob, or angle of its flutes may be. Photograph shows machine in indexing position.

Index is operated by a pawl and ratchet, which takes whatever friction or shock there may be from the operation and brings the index proper in position for the indent lever to drop into the correct index notch. In this way the indent lever and index plate are protected from wear or hard service and maintain their initial accuracy.

The table travel can be operated either by hand or automatically. Referring to the photograph, the short lever seen on the extreme right controls the automatic table feed and reverse mechanism. When this is in the right-hand position it throws in the automatic table drive and reverse, and the large hand wheel shown below this lever is then inoperative. In the photograph, the short handle spoken of is shown thrown to the left. In this position the table may be operated by hand with the large hand wheel, or the long reversing lever shown extending upwards to the stops on the table carriage, and to the left of the short lever, can be used by hand to move and reverse the table back and forth, or any desired amount.

Back of the above reversing lever is shown a large oil well, which connects by means of brass tubes to the internal mechanism, oiling the working parts.

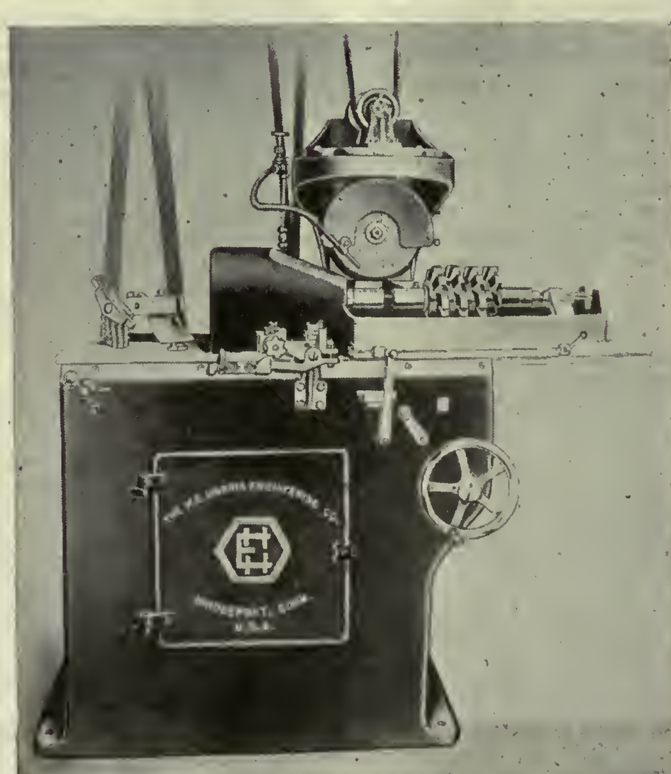
The grinding wheel is set up to suit the work by means of fine vertical and horizontal adjustments, operated by the ball crank handles at the right-hand of the column. These ball crank levers drive a pinion in a rack fastened to the slides, through means of worm gearing.

The grinding head mounted below and the jack shaft mounted above are carried on a heavy circular table that swivels horizontally, so that the wheel may be set to the required angle of the hob.

Truing Attachment

To assist in truing of grinding wheel and setting its cutting face radial, there is provided a diamond tool truing attachment, which is shown resting on the left-hand side of the work table, together with a small hob. This diamond truing device is so arranged that it will true either side of the grinding wheel to any angle required, and will also true the periphery of the wheel and can be used without interfering with the set-up of the hob or cutter in the machine.

After wheel has been trued, a radial gauge is supplied, which is used in setting it to position desired. After wheel has been set in the correct position for grinding, the hob is brought up against the wheel by means of a fine adjusting screw operated by a knurled knob shown at about the centre of front of work table. This rotates the hob about its axis to the emery wheel, always keeping the face of the teeth in the same radial position. When machine is started, there is an automatic feed which operates on the gun lock princi-



GENERAL VIEW OF THE MACHINE.

ple, and which operates once every time the hob is indexed around one complete revolution, and can be set to operate the fine adjusting screw which feeds the hob around against the emery wheel a greater or less amount, according to the amount it is desired to grind off the face of the teeth at each stroke. Besides be- fine adjusting screw which feeds the hob is ground at each stroke during each complete revolution, provision has also been made so that a pre-determined amount may be ground automatically through successive revolutions of the hob, and then the machine, when this amount has been ground off, will automatically stop grinding. This means that the machine may be left alone by the attendant while he is performing other work.

The machine is supplied with a self-priming, non-clogging pump, which throws a copious stream of coolent upon the hob at point of grinding. The flooded lubrication also keeps the hob cool, preventing "burning" or flying emery dust or sparks, and speeds are figured to give the best results. The necessary adjustments are all easy of manipulation from the front of the machine, and are so simple that it does not require a skilled tool-grinder to set-up and operate.

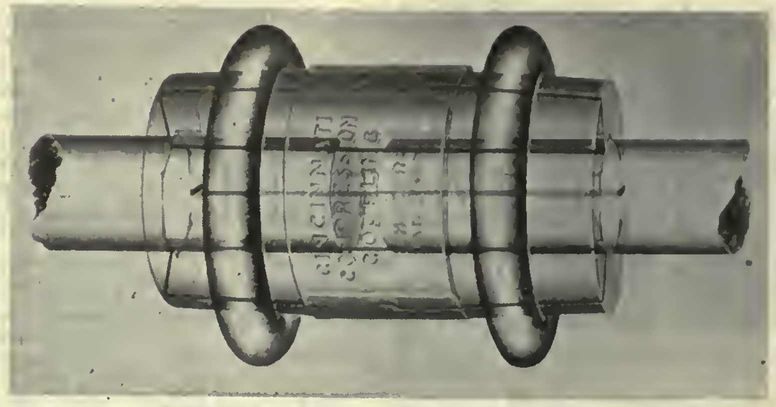
The belt drive from overhead countershaft is rather unique, the driven pulley being carried on the centre line of the swivelling head, as is the cutting face of the emery wheel. This does away with the troubles usually experienced when it is necessary to drive a spindle in several angular positions. There is an idler provided as part of the countershaft, which allows for the vertical adjustment of the head.

One of the valuable features of this machine is the fact that through a very ingenious device, there is a constant and uniform pull that takes up all slack in the spindle indexing and spiral generating mechanisms and permits the grinding wheel to operate on both strokes. Any changes from automatic action to hand action, or vice versa, can be made while the machine is running.

NEW COMPRESSION COUPLING

The Cincinnati Ball Crank Co., Cincinnati, Ohio, have placed on the market a new type of compression coupling for use in connecting line shafting. The illustration herewith gives one a good idea of its appearance and its outstanding feature is simplicity. It can be installed on any kind of shaft in five minutes' time. It is adapted for use in every industry where power is transmitted by means of line shafting.

The construction of this new coupling constitutes a radical departure from the old type flange and bolt connection. It consists of five pieces—three jaws, and two clamping rings. The jaws of the coupling are placed in position about the shaft, and held in place by the longitudinal grooves and notches that lock them together. The forged clamping rings are pushed on over the tapering ends of the jaws, and hammered tight.



VIEW SHOWING CONSTRUCTION OF COUPLING.

A hammer is all that is required for installing the coupling—no dismantling or machining of the shafting is required. It is only necessary to have sufficient clearance between the two loose ends of the shaft to allow the passing of the clamping rings.

The coupling grips the joined sections of the shaft, holding them in alignment. The round, machined sections of the tapered end of the coupling jaws form lines of contact for each ring, and once driven into place it is impossible for the coupling to become loose. It is stated that many of these couplings have been in use three years without a single adjustment since they were installed.

The assembled coupling forms a clean, compact shaft joint. There are no projections on its outer surface to catch a workman's clothing. When used as a reducing coupling, the only additional parts needed are three strips of cold rolled steel to fit between the smaller shaft and the inside of the coupling jaws. These couplings are made in sizes from 15/16 to 3 inches.

SMOTHERING THE FIRE

Fires are something which are much to be avoided, and all precautions are generally taken to eliminate them, yet we are well aware that they persist in cropping up in spite of all precautions.

The next best thing is to be prepared for the fire when it does come, and on this assumption the Canadian Firefoam Co., Hamilton, Ont., have placed on the Canadian market what is known as Foamite Firefoam. To illustrate the uses of this product they have issued a very attractive booklet, entitled 60 seconds and out. They show various instances of fires, and how they were extinguished by means of their product. One outstanding example is a huge 55,000 barrel tank fire at its height. In spite of a strong wind this fire was smothered in 48 seconds, or less than one minute after it had reached its worst.

Briefly, the principal of firefoam is as follows: It is based on the well-known fact that carbonic-acid gas is fire's most deadly enemy. Cover any burning surface with this gas and the fire is quickly smothered. Working on this fact, firefoam was so constructed that the gas was kept over the burning surface in the form of millions of minute bubbles.

The illustration herewith depicts what is termed their 40-gallon Foamite Firefoam engine, and its contents expand to 320 gallons of firefoam upon release. The contents can be discharged on any burning surface at a distance of 50 ft. or more. The type of engine shown is one recommended for plants, buildings and other places where hand extinguishers would be of insufficient capacity.

THIS VIEW ILLUSTRATES THE 320-GALLON CAPACITY ENGINE.

Larger engines of 250, 500, and 800 gallons and upwards are made, all depending upon where they are to be used. Hand extinguishers and fire pails are also handled by this concern, all equipped with the Foamite Firefoam.

One particular advantage, as claimed for this product, is the fact that the foam is comparatively dry compared to water, therefore resulting in less damage. The use of this material is not confined to oil fires, but to fires of any nature in the industrial world.

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PRINCIPAL CONTENTS

Not So Eager To Join

AN attempt by John Fitzpatrick to organize the steel workers in the South Chicago district met with poor success in a meeting which he called recently. A year ago, before the steel strike, Lincoln Hall, Ninety-first Street and Commercial Avenue, South Chicago, was crowded with more than 2,000 enthusiastic workers. All joined the union.

On May 13 only 150 gathered there, although handbills had been distributed among 25,000 workmen. The bills announced that the meeting had been called by the National Organizing Committee of the Iron and Steel Workers of America. It was also stated that a succession of weekly gatherings would be held until the union included every man working in a steel plant in the district.

The steel workers have been tinkered with too much already. If sanity has returned to the point where the appearance of such men as Fitzpatrick and Foster get nothing but an indifferent reception—then so much the better for the steel trade.

Some Common Sense Needed

THE price deflation that has struck many lines in the States has not yet reached the industries of Canada, and as far as many of the lines go, particularly iron, steel, or anything in these classes, the move is not likely to be generally effective.

The market is too empty to permit of much price deflation.

At the same time the trade ought to bear in mind that very serious thought should be given before deciding on more advances.

Unfortunately, there are some lines where the feeling seems to be yet maintained that "we had better get in on this good thing while it lasts."

Reasonable profits should still be the standard of business, rather than maximum exactions.

Firms that are building for the future are well advised if they consider the service they can give to their customers, rather than the money they can wring out of them.

Don't be devoured with over anxiety lest some of the new taxation shall hit you, and that you shall not be able to pass it all along to the next man down in the line toward the ultimate consumer.

If you have an honest case, where your costs and expenses have gone to the point where you must increase, do so openly and honestly.

If you can still do business at present prices, then keep out of the procession leading toward higher costs.

Business is at a point now where a little encouragement and added stability means a great deal. There are projects held in abeyance, because those behind them will not go forward if they think that costs are going to continue upward.

The beating down of all talk of depression and falling-off in trade rests in part with those who are in business themselves.

Increase More Than Exchange

A CANADIAN business man, who comes closely in contact with the machine tool trade, writing to CANADIAN MACHINERY, says:—

Canadian importers of machinery from the United States, it would appear, have been inclined to attach overmuch importance to exchange rates in a raising market. On machinery of a type that is not manufactured in Canada, prices have had practically no stability. In the majority of cases there has been a steady upward trend, yet reports from reliable sources indicate that the exchange has too often been a ruling factor in failures to close. There are cases where the advance in price, since the close of the war, has been insignificant. One case comes to light in which the American manufacturer refuses to consider the absorption of any part of the exchange, claiming that his prices had not advanced, and that his margin of profit therefrom did not permit him to assume any part of the so-called tax, due to the lower buying power of the Canadian dollar.

On the other hand, American manufacturers cite cases where buyers who were in the market months ago for certain necessary equipment and who declined to close, owing to high exchange, are again in the market for the same equipment, now that necessity has become imperative, and have closed at prices which range all the way from 20 to 40 per cent. higher than former quotations—and paying the exchange.

It is true that there has been more stability in the exchange during the past few months and that buyers feel little improvement may be hoped for in the near future, yet the predictions as to advances in machinery prices would seem to have continued good ground for serious consideration of the lower prices then prevailing. The saving on price would have done much more than offset the exchange in a good many cases.

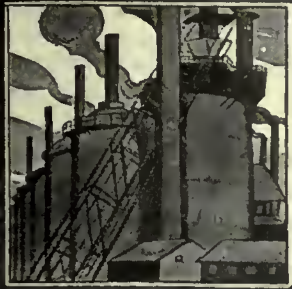
The great surplus of munition machinery seems to have disappeared as if by magic, and prices have responded to steady demand that had to be met in spite of high material and labor.

Why Freight Rates Are High

THE steamer Greleden arrived in London in November, 1919, from Bombay. Ninety-five days were occupied in discharging and loading cargo. In 1917 five vessels were unloaded in 32 days, or an average of about six days for each vessel. The time taken to discharge the same vessels in 1919 was 165 days, or 33 days per vessel.

There is a woeful waste going on here. It looks as though one way of serving the end of a strike was to stay at work and keep putting on the brakes.

Ocean rates are about 60 per cent. below the peak levels of the war, but instead of coming down, they are going up. The average time now spent by a ship in British ports has increased from 6.86 to 15.5 days, due to the longer time taken to handle the same tonnage.



MARKET DEVELOPMENTS

Conditions Are Not Helping Business Now

But There Is a Good Volume of Trade Moving in Spite of Drawbacks—Machine Builders Are Using Trucks to Get Shipments Out to the Roads That Can Handle Them.

BUSINESS conditions in steel, iron and machinery remain sound in spite of conditions, rather than with their assistance. Transportation facilities are not improved, and there are warehouses in Toronto that have not had a shipment come through from the U. S. rollers in the last five weeks. Several Canadian firms that depend largely on supplies of material from these mills have had their own men scouring the country between the mills and the border trying to locate their cars. In several cases they have been successful, but it has done them very little service. It is one thing to locate cars and quite another to get them moving toward the point of destination.

Transportation is also holding up shipments of machinery. Many of the makers are using trucks to get tools to the lines that enter Canada via Montreal, and nearly all of the shipments are now coming in that way. Of course, some buyers will make money by delay as they now get the benefit of the 7½ per cent. war tax coming off, but in a case where material or equipment is badly needed it would pay a firm better to have this amount added and get quick delivery.

Some dealers are not very clear on the interpretation of the one per cent. tax. One side holds that the dealers should absorb it, while others are passing it along. In this way it is possible, in some lines, that the ultimate user might pay the accumulated tax on three or four transfers.

The scrap metal market is dull. The coke situation has made it so that the large melters are not taking on scrap. Even the much-wanted heavy melting steel is not in favor now, and dealers intimate that they would regard it as speculation to take on much of this, although they have to buy as they are committed against certain shipments on contract.

SHORTAGE OF SHIPMENTS KEEPS THE PRICE FROM DROPPING IN MONTREAL

Special to CANADIAN MACHINERY.

MONTREAL, June 3.—"The inability to move material in sufficient quantities to meet the existing demand is the outstanding factor in the steel market. The shortage of cars continues to be a serious problem, particularly in the States, and some of the mills there from which our supplies come have thousands of tons of finished material in the yards awaiting shipment." This statement from a dealer here illustrates quite clearly the general condition as it applies througout the steel districts. The receipt of raw materials at the mills is also below normal, so that operations are frequently limited to the supplies coming in. Ever since the recent outlaw strike on the U. S. railroads the transportation by rail has been very irregular, owing to the slowness of the men in returning to work. As a result the demoralized condition is more or less evident. "It is quite apparent," remarked the dealer, "that with an adequate supply of cars, and the ability of the roads to take care of the shipments, that a weakness would develop in most of the steel lines." Considerable concern is felt in this district over the scarcity of cars, particularly in the way of accommodation for the shipment of coal. Many of the larger manufacturers are beginning to feel that the situation will necessitate the curtailment of activity, if not the closing down of the plants. It has become necessary for strict conservation wherever possible. Dealers here report a good remand for steels but emphasize the pronounced factor of under-supply. While it is difficult to obtain any definite statement as to early improvement, some are of the opinion that a steady betterment may be looked for from now on, but not of sufficient magnitude to alter the present high quotations that prevail in all markets. Warehouse supplies are still impossible, especially on tubes, sheets and plates, of the standard sizes. Chequered floor plates, which have been quoted at 9 cents, are now selling at 8 cents, for the heavy sizes and 8 4-10 for 3-16 inch. Seamless tubes are still in good demand with the supply below the normal. The 2 inch size has advanced $5 per 100 feet, the present quotation being $35 per hundred.

Used Tools Good Sellers

Machine tools activity, especially in new equipment, is becoming more a question of price, and the prospective purchaser of tools is now influenced more than formerly by the price. The case must be very urgent before the user will close for the machine that has shown a recent advance in the price.

Dealers in second hands and rebuilds have reported a good business of late and anticipate a steady trade while high prices dominate the new tool market. Some manufacturers who have tools on order are looking forward to getting the same for considerably less than at the time of order, owing to the cancellation of the 7½ per cent. war tax. The supply trade continues brisk with good business reported in British lines.

Listless Scrap Market

The listless state of the scrap market has been continued throughout the past week and sales have been generally light in character. Dealers here are not anxious to buy, for stock when the disposal of the material is so uncertain. The local demand for scrap has fallen off considerably and foundries are light buyers. Machinery scrap is still holding first place, but in reduced proportion. Prices are quite firm on the basis of last week.

CANADIANS HIT HARD BY STRIKE

Some Places Have Not Had a Shipment Through in Five Weeks

TORONTO. — Those closely in touch with the market agree that inquiries are less brisk than they were a few months ago, and that much of the buying that is taking place is the result of smaller inquiries.

The railroad strike in United States has been blamed for much of the trouble that is befalling Canadian industry and there is nothing better to report this week.

Machine tool dealers claim that many of their principals are making every effort to get shipments out to the Canadian trade and are using motor trucks in order to get their goods to lines that are moving. Most of the shipments reaching here now are coming in by way of Montreal.

The delivery schedule of some makers of machine tools has been spread over a good many weeks in the past, and wi h the added trouble of getting the goods moving on the rails, there is a greater feeling of uncertainty in the whole situation.

Nothing for a Month

"We have had nothing in our warehouse for a month now," was the statement of one large warehouse interest to CANADIAN MACHINERY. "We know of shipments that have been on the way for five weeks and that is all we know of them. They are some place and we don't know where that some place is, and if we did it would help very little. The superintendent of one Canadian concern has been for some days on the go between the border and several of the mills where they are supposed to have shipped out car lots. This particular firm has 37 cars of material, and they were paid for, so anxious was the firm to get the stuff. In one case several of the cars were located on a siding. They had been brought along some 15 miles from the point where the mills were located on a little road that runs from the mills to the main line. There they stopped, and there they are now. The gentleman who went to try and start them had to give it up as a bad job. He could not get any action. He reports that yards are full of freight cars and that every car loaded means that another car has passed out of the service as far as being available is concerned. He thinks it will take months, even should they settle their strike, to get things moving again. Many cars, to all intents and purposes, are lost.

Another dealer pointed out that the trouble with transportation had a bad effect on trade. A firm might want certain material, but upon hearing of the trouble of other concerns in getting their supplies, conclude that it was no use in going into the market at all until things became better. "That is a serious mistake," commented the dealer, "as one never knows what they can get until they state their case and have a try. Very often there are small lots coming in that could be used to advantage. It is the insistent purchaser that generally gets his case attended to."

POINTS IN WEEK'S MARKETING NOTES

The railroad strike is blamed for the dullness in the New York machine tool market.

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British firms are buying machine tools in the States as they cannot secure enough of them in their home market.

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Steel piled at the mills and waiting shipment is now estimated at between a million and a half and two million tons.

—

Steel Corporation prices to Canada are claimed to be due to the fact that Old Country interests are getting higher prices.

—

Pittsburgh reports the iron and steel market as quiet—almost stagnant in spots.

—

The scrap metal market continues weak, and dealers are not at all eager to buy except under the market quotataions.

About the Taxes

Some of the dealers in small tools are wondering how they get in or out of the new tax of one per cent. on all sales, and have not yet figured out where the passing around of the sale stops. Take a case of $100 worth of drills, for instance, purchased from a Canadian plant. The dealer figures that he has to pay $101, that is $100 plus the tax of one per cent. on sales. The dealer in turn adds his selling profit of ten per cent., which brings the amount to $111.10. The Government will collect one per cent. on his business, so is he to pass it on or pay it? That is where the difference of opinion comes in. Some of the dealers want to pass on the one per cent., making their sales price $112.21, while others hold that the dealer should absorb this. "This thing could go on indefinitely if we all pass it along," was one expression, "and the man who bought the goods in the end might find that he had to pay three or four taxes. I do not think it is the intention of the Government that the trade should keep on passing these things along. It is being absorbed in our concern and will simply reduce our profits by that amount. Here is what might happen: A recognized jobber would buy in the first place, and sell to a store that did retail and wholesale trade. This store might sell again before it ultimately reached the consumer, and by this time there would be five taxes piled on the article on top of the original price." There is quite a difference of opinion among the dealers, and it is likely that some conferences may be held to determine just what course of action will be followed.

Cutting Out the Jobbers

There are stories in the street also that some of the jobbers are receiving notice that they have been cut off by certain of the makers. This refers to small tools, especially, such as drills, taps, dies, reamers and cutters. There seems to have been a general move in this direction, as some jobbers have been cut off by certain factories, while others have been retained.

There is also some talk that there may be a further readjustment in price to meet some of the prices that are being used by the agents of Old Country firms. It is claimed that in several lines of small tools the Old Country prices are about five per cent. under the selling schedule of the Canadian makers, and there is a feeling that something should be done to meet this price.

Scrap Market is Very Dull

There is a very apparent weakness in several lines of scrap metal. Copper is easing up considerably and there is not much demand. Some of the dealers claim that used copper is not worth what is being quoted in this paper, but they are willing to allow the price to stand for the present.

Steel is weaker in the Canadian market as well as in the States. The coal and coke problem in this country is at the bottom of the trouble. The railway strike tied up the big melters that might otherwise have come into the market for replenishment in steel scrap. But as it is they are staying out. In some cases dealers will go as far as to state that they are out of the market for steel scrap. Of course many of the larger dealers have to buy, as they are committed to a certain tonnage under contract and they must take on material against this. But if they are taking on anything for stock, or speculation, they would want it to be at a price under the market. Iron scrap is more in demand and stove plate still finds buyers.

ERRATA

In our April 22nd issue we stated that the Albert Herbert, Ltd., Coventry, England, were Canadian agents for the E. G. Herbert Co., Manchester. This was an error, as Williams & Wilson, Ltd., Montreal, are agents for this concern.

The Galt Industrial Housing Company has been incorporated, with capital of $100,000, to acquire lands in or near the said city of Galt, and to build and make thereon dwelling houses of moderate size, and improvements and conveniences, to be sold at moderate prices or to be rented at moderate rents, etc.

STEEL TRADE IS NOT MUCH BETTER; PITTSBURGH USES THE WORD STAGNANT

Special to CANADIAN MACHINERY.

PITTSBURGH, June 3—A distinct improvement has now occurred in traffic conditions on the railroads. This is admitted by iron and steel producers generally, and as they have been quite cynical in the past as to reports and promises of improvements on the railroads their word can readily be accepted at its full import.

Of course the condition is still very bad, despite the improvement, for there is not much more than a trend in the right direction. There are better car supplies, but by no means adequate supplies. Freight is moving more expeditiously, or rather less slowly, to consignees, but there is almost as much material en route as there was, in other words several times the normal quantity, besides something like a million and a half tons of steel accumulated at mills and not shipped at all.

Production of pig iron and steel has increased only slightly. There is no great desire to increase production, it being much more important to increase shipment. Production of pig iron and steel may be estimated at close to 80 per cent. of capacity, on the assumption that the production rates in March, the highest attained since October, 1918, were 90 per cent. of capacity.

The activities of the Interstate Commerce Commission, which are chiefly responsible for the improvement in railroad conditions, have assumed a broader character. Various orders have been issued which are aimed directly at relieving congestion and improving car supply. In the matter of granting priorities for the movement of particular commodities, the commission has been very conservative. It ordered large numbers of box cars west, for the grain movement, but even after urgent representations as to the need of box cars for moving tin plate about ten days were spent in investigation before an order was issued giving a fortnight's priority to box cars intended for tin plate loading. In the case of coal there are claims and counter claims. At Washington it is claimed that orders for diversion and movement of cars have been issued such as should greatly increase the supplies of cars at coal mines, while on the other hand some Pittsburgh district coal operators express the opinion that the railroads are discriminating against the coal mines and in favor of the manufacturing industries. It is hinted how v r that t may be due not to the lack of orders on the part of Washington, but to the railroads being slow to comply with the orders.

The Pittsburgh & Lake Erie (New York Central system) is doing better. For a long time there were scarcely any operations on what used to be called "The Little Giant," on account of its density of traffic and shortness of line. From the iron and steel viewpoint it runs from Monessen, 25 miles up the Monongahela River, where are located the Pittsburgh Steel Company, Page Steel & Wire Company and National tin plate plant of the American Sheet & Tin Plate Company, through Pittsburgh and out to Youngstown. Now there is a fair amount of single car movement and a good bit of solid trainload movement on the road.

As to the rail strike itself there is not a great deal of change. A few more of the "vacationists" have returned to work, but there are not many of these men left. They are either back on their old jobs or they have secured employment elsewhere. The railroads have been breaking in new men, and on this process is their chief dependence. For a fortnight the Bessemer road has been functioning normally, after having been out a couple of weeks or so.

Canadian Prices Advanced

The Steel Corporation has advanced its Canadian prices $20 a net ton on sheets and tin plates and $2 a ton on bars, shapes and plates. Previously its Canadian prices had been the same as those charged to buyers in the United States, being the Industrial Board schedule of prices which became effective March 21, 1919. It has been the more common practice of the mills in the United States to regard the Canadian market as part of the really domestic market, rather than as part of the export market, which might preferably be called the overseas market. Inasmuch as the independent producers have been charging much higher than Industrial Board prices even to strictly domestic buyers, and of course also to Canadian buyers, the Steel Corporation was extending to Canada its efforts to hold down the steel market, and evidently has concluded that the thing went too far, particularly as British prices have been advancing from time to time. The new Canadian prices of the Steel Corporation are still much below those being obtained in overseas exports, and are as follows: Tin plate, $8 per base box, 100 pounds; black sheets, 28 gauge, 5.35c; galvanized sheets, 28 gauge, 6.70c; blue annealed sheets, 10 gauge, 4.35c; bars 2.45c; shapes, 2.55c; plates, 2.75c, all f.o.b. Pittsburgh, plus freight to destination. It cannot be assumed that the advance in Canadian prices foreshadows any advance by the Steel Corporation in the domestic market.

Stagnant Markets

All branches of the iron and steel market are extremely quiet, practically stagnant. Some of the independent producers state that they are in receipt of a very considerable volume of inquiry, but there is reason to suspect that the inquiry results from the conservative attitude of the mills as to making sales, whereby an inquiry is multiplied in importance by going the rounds. Much of the inquiry, probably, is of tentative character, put out to see whether the independents will recede from the prices they have been maintaining of late, since many consumers are looking for an eventual recession of the independent market to the Steel Corporation level. The independents are quite indisposed to cut prices, and perhaps they are strengthened in their views by the very fact that large quantities of unshipped steel, made on order, have accumulated. As the railroads limber up and this extra steel goes forward, it would be awkward if the customers developed an indisposition to take all the deliveries. Naturally the mills desire to clear off their order books as far as possible before any actual recession occurs in open market prices.

As to prompt deliveries, however, there is clearly a recession in price. Prompt deliveries were bringing so much more than the prices charged by large independents for deliveries in, say, two to five months, that this weakening has no particular effect upon the forward market.

Pig Iron

There is a very involved situation in pig iron. On the surface prices show an advancing rather than a receding tendency, but the only market that exists is the prompt market, and it is one thing for prompt deliveries in small lots to command full prices, or even advanced prices, and quite another thing for consumers to be taking hold for late deliveries, say for the second half of the year. The latter they certainly are not doing. On small sales Bessemer is established at an advance of 50c, at $43, valley, basic remaining at $43.50, valley, and foundry at $45, valley. Freight to Pittsburgh is $1.40.

The coke movement is better. The by-product ovens are getting more coal, and as to the Connellsville region, the Connellsville *Courier* reports coke production in the week ended May 22 at 178,250 tons, an increase of 23,850 tons. Better car supplies since then suggest that the present rate of production is still higher.

NEW YORK BLAMES STRIKE FOR HALT

Quietness is More Marked Than at Any Time Since the Beginning of The Year

Special to CANADIAN MACHINERY.

NEW YORK, June 3.—Conditions are pretty much the same as they have been reported in the past two or three letters, there being very little injury and few orders. The machine tools markets have not been so dull since the early part of last year, following the signing of the armistice. Reports of salesmen who have been callingg upon their customers indicate that the trouble is traceable almost entirely to the railroad situation. The uncertainty as to when the freight congestion will be cleared up has created a spirit of hesitation. Moreover, buyers who cannot get shipments of machines already on order feel that there is little use in placing further orders at this time.

Aside from the railroad inquiries which are pending, the trade has few prospects for business worthy of special note. The Norfolk & Western and the Chesapeake & Ohio railroad lists are pending, and orders may be placed soon. A new list for about 150 machines from the Atlantic Coast Line was received by the machine tool trade last week. The Southern Pacific Railroad has bought about $200,000 worth of shop equipment, most of this business going to one company. Other railroads are expected to come into the market soon, notably the New York Central, which is preparing a list of its shop requirements.

Export business is only fairly active. England is a good buyer, the inability of British machine tool builders to make early deliveries creating orders for American machine tools. An export inquiry for about 20 machines has been sent out by the West India Sugar Finance Corporation, New York.

ALL REPORT PROSPECTS ARE BRIGHT FOR BRITISH GOODS COMING TO CANADA

A well-attended gathering of the Canadian Association of British Manufacturers was held in the Mossop Hotel, Toronto, the occasion being a special meeting preceded by lunch. There were quite a number of speakers, including Mr. Field, the British Trade Commissioner, and Controller Maguire, who attended in the place of Mayor Church, who was called out of town. Mr. Marshall, the president, was in the chair, and after a short introductory speech, called upon the vice-president, Mr. Harris, who gave a short and interesting talk on the status and achievements of the Association. A proposal had been made to have the Association of British Agencies join hands with the Association of British Manufacturers, which was to be taken up at subsequent meetings of the executive. Mr. Harris spoke of the work of the transportation committe, which had at the present time much important work in connection with proposed re-classifications by the railway companies to engage its attention. Mr. Harris was followed by Mr. Harold Wilson, chairman of the textile section, which is the largest in point of membership of any of the sections of the association. Mr. Wilson urged the necessity of getting a larger number of British manufacturers to join as members, as he felt this would largely enhance the importance of the association. Mr. Wilson also dwelt on the necessity of larger advertising by British firms in the Canadian trade, a point which was emphasized by several of the speakers. Mr. Marshall then called on Mr. Field, the British Trade Commissioner in Toronto, who, after referring to the progress made by the Toronto and Montreal branches of the Canadian Association of British Manufacturers, spoke of the close co-operation between the Association and the Trade Commissioners in Canada. In these days when sentiment is strongly in favor of trading within the British Empire, and there are good business reasons for the development of Empire trade, the Association, he said, has scope for important work and its membership will undoubtedly increase rapidly.

"There are about 1,200 United Kingdom firms represented in Ontario," said Mr. Field. "The opportunity for United Kingdom trade in this market is good in a number of lines, despite the competition of foreign companies. Given aggressive treatment by the British manufacturer this market will undoubtedly yield a substantial volume of business, as it has done in the past."

During the war the outlying parts of the Empire, which had depended to a large extent on the United Kingdom for their supply, were thrown on their own resources and were compelled to develop their own industries and are now able to produce goods in wider range and greater quantity than at any previous period of their history, and it is not always appreciated how completely industries in the United Kingdom were disorganized and the immense effort that had been necessary to re-establish them on a business basis. The demand for goods of all kinds from the Dominions is at present much greater than normal, whereas the output of the United Kingdom is still considerably below its pre-war standard, while the home demand for replacement of the machinery of production and trading stocks is still very large. It is therefore, only possible to supply a small proportion of the requirements of each individual market.

"By the end of this year, however, the United Kingdom will probably have regained its position as the first trading nation of the world.

"The work of the three British Trade Commissioners in Canada has greatly increased and a large number of inquiries for British goods are being received. The value of orders secured directly as a result of early information supplied by my office has, since the establishment of the office two years ago, more than equalled the cost of maintenance of the office for many years to come. In other words, in a commercial sense, the office is on a business basis.

"The British Trade Commissioner's offices in Canada are supplying a large number of reports to the Department of Overseas Trade in London, with regard to the Canadian market for United Kingdom manufacturers, among whom these are being circulated."

Controller Maguire, after apologizing for the absence of His Worship, Mayor Church, expressed his pleasure at being present at such an influential gathering, and spoke of the preference felt by the municipal government of Toronto for British made goods, when they had to purchase outside of the Dominion. This was a preference earned by the high standard of materials which they had always received. He spoke favorably of the initiative shown by agents of British houses, and also spoke of the necessity for more extensive advertising of British goods by British manufacturers. Mr. Bunney, of the steel section, which represents the most influential section of the association in point of value of importations, mentioned the fact that while the proportion of expense of U. S. firms in advertising was 25 per cent. of the selling cost, the proportion of expense of the British firms in this direction was only a little over 1 per cent. The publicity activities of the association were explained by Mr. Beale, who told the members that a series of booklets dealing with the various sections were in course of publication, which would be of interest and value to all the members. The general tone of the speakers was very optimistic towards the prospects of British trade in Canada, and the meeting closed with a feeling of general satisfaction for the work done so far, and the good results to be attained in the future.

OLD LAKE CAPTAIN HAS PASSED AWAY

Was Ready to Shoot Up All Concerned When Ordered to Pull Down Union Jack

Kingston.—The death occurred in the General Hospital of Capt. William Simmons, aged 78. He had sailed on the lakes for over fifty years, retiring some years ago. He was born in Ireland and had lived in Canada 70 years. He is survived by several sons, who are proprieters of a hardware store here. He was much in the limelight in 1906, when he entered Charlotte harbor with the schooner Acacia, of which he was owner. It was the 4th of July, and the Union Jack flew from the Acacia's masthead. The customs officer at Charlotte ordered him to lower the flag or float the Stars and Stripes with it. The old captain refused, and when the customs officer and others attempted to board the vessel to carry out the former's order, Capt. Simmons held them up with a revolver and threatened to shoot if they made a move The incident was reported to Washington, but was soon smoothed over.

Unfair and Unwise Proposal for Increase of 300 to 500% to Meet Increased Costs of Less Than 100%

A DRASTIC increase in postal rates, amounting to 300% the first year, and 500% the second year, is proposed in the resolution of Hon. Martin Burrell to increase postal rates on second-class matter from ¼ cent per lb. to 1 cent per lb. in 1921, and 1½ cents per lb. in 1922.

The reason given for this terrific increase of 300 to 500 per cent., is that the railroads have been awarded a higher rate for carrying mail matter. *This increase, however, is less than* 100%. Salaries of postal officials have been increased. *These increases have been less than* 100%.

The Government may need increased revenue, but why inflict a 300 *to* 500% *increase* on second-class matter, when increased costs of salaries and transportation are less than 100%?

A similar percentage increase in first-class mail would increase the cost of minimum rate for letters from 3 cents to 12 cents in 1921 and 18 cents in 1922.

When the Government reduced the rate of postage some 20 years ago on second-class matter from ½ cent per lb. to ¼ cent per lb., and at the same time reduced the letter rate from 3 cents to 2 cents, the result was not a deficit, but a surplus, and the first surplus the Post Office Department had shown for years. These reductions in rate of postage were accompanied by increases in salaries to postal officials, and also by regulations which eliminated much unnecessary waste.

A low postal rate was granted on second-class matter to encourage establishment of Canadian newspapers and periodicals. Is it fair when publishers have invested large sums of money to suddenly reverse the policy and make a drastic increase in rates which will ruin many worthy publications, and cripple the service given by the majority which survive?

Every dollar added to the price of a magazine narrows the circle of readers, and the men who would fail to subscribe are the ones who need information most.

This drastic increase would place a crippling tax on the periodical press, which, next to the schools themselves, is the greatest educational power in the country.

It would seriously retard our development in agriculture. in trade, in manufacturing, in medicine, science and engineering by restricting the spread of information essential to development in these lines. This retardation would result in a tremendous annual loss to the country — a loss far greater than the revenue which the proponents of this measure (erroneously, we believe) expect.

The Canadian publishers of magazines, religious and educational papers, farm papers, trade and technical papers are already working under handicaps not experienced in other lines of business. They are subject to what is equivalent to "dumping" on the part of American publishers of magazines. The very large production by American magazine publishers takes care of the overhead expenses so that each can quite easily provide for an additional 5,000 or 10,000 copies for the Canadian market at relatively small additional expense. This extra run for the Canadian market is dumped into Canada by freight or express absolutely duty free.

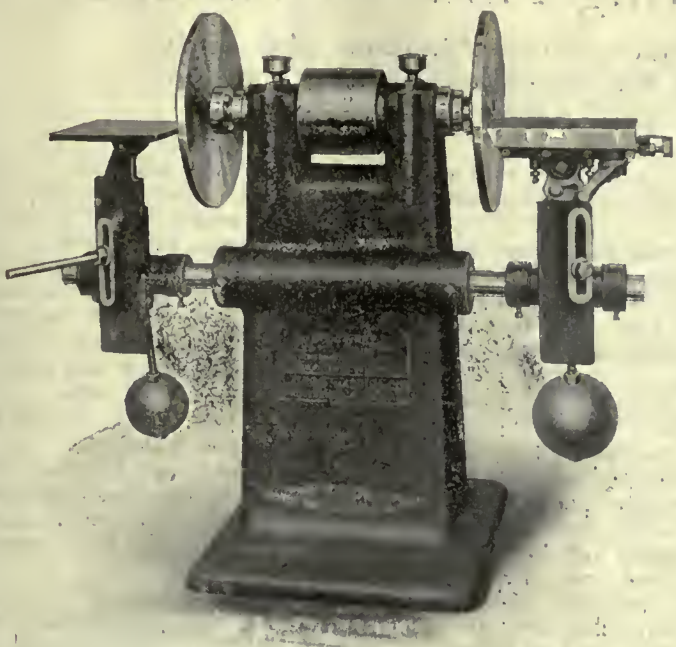
The Canadian publisher must provide for his overhead with a much smaller circulation and is subject to additional expense amounting to over 40% represented by the Customs Tariff on equipment and supplies used in the production of his magazine.

Canadian National Magazines circulate to a total of approximately 5,000,000 copies annually. As against this we have a total circulation in Canada of American weekly and monthly magazines of approximately 20,000,000 copies annually. Would it not be in the public interest instead of further penalizing Canadian magazine publishers to provide even greater encouragement such as would tend to promote a much larger circulation of distinctively Canadian periodicals?

Seven years ago Canadian publishers asked for an investigation of cost of carrying various classes of mail matter, but this has not taken place. We believe such an investigation would bring out many ways in which economies could be effected.

The public has always been keenly interested in educational matters. We believe they would object strenuously to any further percentage of increase than is justified by increased expenses. In no case is this higher than 100%.

The work of magazines, business and religious papers should not be crippled to make up deficits in other departments. They should not be penalized to the extent of 300 to 500%. The increase in postal rates on Canadian publications should not be more than 100% at this time, and it would be obviously unfair and demoralizing to enforce the proposed increase of 300 to 500%.



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INGERSOLL

Railway Scrap Sorting Finds 98 Varieties

Great Saving Has Been Made Since Attention Has Been Given to Specializing in This Business—Sheet Used by the Railway Storekeepers' Association

THE care that is taken by large firms, especially transportation companies, in the grading and classifying of scrap material, would be a revelation to the layman. The average man's idea of the scrap metal business is too apt to be based on the sight of a peddler's wagon plodding along with a few pieces of scrap rattling around in the bottom of the cart.

Some of the large railway companies, since paying strict attention to sorting scrap, have reported savings of hundreds of thousands of dollars per year.

A very good idea of what classifying scrap means in a railway company's business can be gathered from a perusal of the report sheet on scrap used by the Railway Storekeepers' Association. The description of the classes follow:

1. Arch bars and transoms, iron.
2. Arch bars and transoms, steel.
3. Axles, iron. Driving and other axles, 6 in. diameter and over.
4. Axles, steel. Driving and other axles, 6 in. diameter and over.
5. Axles, iron. Car, tender, engine truck and other axles, car and locomotive, under 6 in. diameter.
6. Axles, steel. Car, tender, engine truck and other axles, car and locomotive, under 6 in. diameter.
7. Angle bars, splices and fish plates, iron. For patented oints see No. 36.
8. Angle bars, splices and fish plates, steel. For patented joints see No. 36.
9. Brake beams, uncut. All metal brake beams.
10. Bolsters, uncut (except cast steel). To include all metal built up type body and truck bolsters.
11. Boilers, uncut. Locomotive and stationary boilers, locomotive tanks, other heavy oil tanks, fire boxes without flues or trimmings, but including mud rings.
12. Boilers, cut up. Locomotive and stationary boilers, locomotive tanks, other heavy oil tanks, fire boxes without flues or trimmings, but including mud rings, cut in sheets and rings.
13. No. 1 busheling. Iron and soft steel pipes and flues (free from scales); tank and bands No. 12 and heavier, boiler plate punchings and clippings, and soft steel and iron drop forgings and trimmings; nothing to be over 8 in. long or wide, free from galvanized or tin stock.
14. No. 2 busheling. Cut hoops, sheet, cotton ties and similar light material; nothing to be over 8 in. long or wide; bundled wire and bundled sheet suitable for busheling without further preparation; bundles not to weigh over 40 lbs. and not to be over 15 in. in height, width or length; all free from hard steel, cast and malleable and galvanized or tinned stock.
15. No. 1 railroad cast. Pieces weighing 150 lbs. or less, includes new grates, new stove plate; clean cast iron culvert, soil and water pipe; free from burnt grates, burnt stove plate and brake shoes.
16. No. 1-A railroad cast. Cylinders and wheel centres.
17. No. 2 railroad cast. Pieces weighing over 150 lbs.; can include new grates and new stove plate; free from burnt grates, burnt stove plate; also exclusive of cylinders and wheel centres.
18. No. 3 railroad cast. All kinds of burnt, centres, including grate bars, grate frames, stove plate, hand car and truck wheels with wrot iron spokes.
19. Cast iron borings. Clean and free from other metals, dirt and lumps.
20. Chain, iron. All sizes regardless of length. (May be included in No. 1 Railroad Wrot).
21. Chain, steel. All sizes, regardless of length.
22. Channels, iron. Car truck, cut apart.
23. Channels, iron. Car truck, uncut.
24. Channels, steel. Car truck, cut apart.
25. Channels, steel. Car truck, uncut.
26. Steel couplers and knuckles. Cast steel couplers, knuckles and coupler heads.
28. Frogs and switch points, uncut. 50 lbs. section and over.
28. Drillings and oily chips. Wrot iron and soft steel.
29. Flues and pipes. Flues and pipes, boiler flues, wrot iron and steel pipe, regardless of lengths, without removing scrap fittings, such as couplings, elbows, tees, etc.
30. Limited iron and steel. All kinds (except flues) from the interior of boilers, which are incrusted with lime or corroded by the action of water, such as Crown Bars, Crown Bar Bolts, Staybolts, etc.
31. *No. 1 structural and shaped iron, cut up. Channels (except car truck channels, see item 22), angles, tees, "I" beams, girders and columns, except cast.
32. *No. 2 structural and shaped iron, uncut. Channels (except car truck channels, see item 23), angles, tees, "I" beams, girders and columns, except cast.
33. *No. 1 Structural and shaped steel, cut up. Channels (except car truck channels, see item 24) angles, tees, "I" beams, girders and columns, except cast.
34. *No. 2 structural and shaped steel, uncut. Channels (except car truck channels, see item 25) angles, tees, "I" beams, girders and columns, except cast.
35. *Structural and shaped iron and steel, mixed, uncut. Channels (except car trucks), angles, tees, "I" beams, girders and columns, except cast.
36. Rail joints. All patented joints.
37. Malleable. All malleable castings.
38. No. 1 iron rail. 5 ft. and over 50 lbs. and over standard "T" section, free from frog, switch and guard rails and bent and crooked rails.
39. No. 2 iron rail. Cropped rail ends, 3 ft. and under.
40. No. 3 iron rail. 3 ft. long and under 5 ft., 50 lbs. and over standard "T" section; also bent and crooked rails.
41. No. 4 iron rail. Frog, switch and guard rails.
42. No. 1 steel rail. 5 ft. long and over, 50 lbs. and over standard section, free from frog, switch, guard, bent, curved and circle rails.
43. No. 2 steel rail. Cropped rail ends under 3 ft. long, 50 lbs. and over standard section.
44. No. 3 steel rail. 3 ft. long and over and under 5 ft., 50 lbs. and over; split heads and worn flanges, curved and bent rails, free from frog; switch and guard rails.
45. No. 4 steel rail. All sections of rail not coming under specifications of No. 1, 2 or 3 rail, including frogs, cut apart, guard rails and switch points. Does not include frog fillers or plates.
46. No. 1 light steel. Under ¼ inch, consisting of cut smoke stacks, netting, wire rope (not galvanized) hoops, band iron and steel, pressed steel hand car wheels, scoops, shovels, iron, wire, free from galvanized iron and tin. Exclusive of material coming under classification of "Busheling."
47. No. 2 light sheet. Galvanized iron and tin, galvanized rope, roofing, tinware, etc.
48. Heavy sheet. ¼ inch and over, including tank, boiler and fire box steel and iron, cut up, bridge plates, frog and crossing plates. Exclusive of material coming under the classification of "Busheling."
49. No. 1 brake shoes. Plain gray iron.
50. No. 2 brake shoes. Miscellaneous, including all shoes with steel back or with steel or wrot iron insert, both driving and car.
51. No. spring steel. Flat; includes all pieces of flat spring steel, old or broken leaf or elliptic springs, from which the bands and bolts have been removed.
52. No. 2 spring steel. All coil springs made from steel 3-16 inch and over in diameter.

Continued on Page 100.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$42 40
Lake Superior, charcoal, Chicago	57 00
Standard low phos., Philadelphia	50 00
Bessemer, Pittsburgh	43 00
Basic, Valley furnace	42 90
Toronto price:—	
Silicon, 2.25% to 2.75%	52 00
No. 2 Foundry, 1.75 to 2.25%	50 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 50
Steel bars, base, Toronto	5 50
Iron bars, base, Montreal	5 50
Steel bars, base, Montreal	5 50
Reinforcing bars, base	5 00
Steel hoops	7 00
Norway iron	11 00
Tire steel	5 75
Spring steel	10 00
Band steel, No. 10 gauge and 3-16 in. base	6 00
Chequered floor plate, 3-16 in.	8 40
Chequered floor plate, ¼ in.	8 00
Staybolt iron	9 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	4 00
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 67 to 5 50
Small shapes under 3"	3 62

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points	C.L.	L.C.L.
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

	Gross. Montreal	Toronto
Lake copper	$25 00	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	72 00	65 00
Spelter	12 00	12 00
Lead	11 50	11 00
Antimony	14 50	14 00
Aluminum	34 00	36 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 7 25	$ 7 25
Plates, ¼ up	6 50	6 50

PIPE—WROUGHT

Price List No. 44—April, 1920.

STANDARD BUTTWELD S/C

	Steel Black	Steel Galv.	Gen. Wrot. Iron Black	Gen. Wrot. Iron Galv.
⅛ in.	$6 50	$ 8 60	....	....
¼ in.	5 18	7 26	$ 6 43	$ 7 66
⅜ in.	5 18	7 26	6 43	7 56
½ in.	6 84	8 42	7 27	8 84
¾ in.	8 45	10 68	9 03	11 16
1 in.	12 50	15 64	13 36	16 49
1¼ in.	16 91	21 16	18 06	22 31
1½ in.	20 21	25 30	21 59	26 68
2 in.	27 20	34 04	29 05	35 89
2½ in.	43 00	53 82	....	....
3 in.	56 23	70 38	....	....
3½ in.	71 30	88 32	....	....
4 in.	84 48	104 64	....	....

STANDARD LAPWELD S/C

	Steel Black	Steel Galv.	Gen. Wrot. Iron Black	Gen. Wrot. Iron Galv.
2 in.	$30 90	$37 74	$34 60	$41 44
2½ in.	45 34	56 16	51 19	62 01
3 in.	59 29	73 44	66 94	81 09
3½ in.	73 14	90 16	82 34	99 36
4 in.	86 66	106 82	97 56	117 72
4½ in.	0 98	1 23	1 24	1 49
5 in.	1 15	1 44	1 44	1 73
6½ in.	1 49	1 86	1 87	2 25
7 in.	1 94	2 43	2 42	2 90
8-L in.	2 04	2 55	2 54	3 05
8 in.	2 35	2 94	2 92	3 51
9 in.	2 81	3 52	3 50	4 21
10-L in.	2 61	3 26	3 25	3 90
10 in.	3 36	4 20	4 18	5 03

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.

4½" and larger 50%.

4" and under, running thread, 30%.

Standard couplings, 4-in. and under, 30%

Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices.

Per 100 Pounds.	Montreal	Toronto
Copper, light	$15 00	$14 00
Copper, crucible	18 00	18 00
Copper, heavy	18 00	18 00
Copper wire	18 00	18 00
No. 1 machine composition	16 00	17 00
New brass cuttings	11 00	11 75
Red brass cuttings	14 00	15 75
Yellow brass turnings	8 50	9 50
Light brass	6 50	7 00
Medium brass	8 00	7 75
Scrap zinc	6 50	6 00
Heavy lead	7 00	7 75
Tea lead	4 50	5 00
Aluminum	19 00	20 00
	Per Ton	**Gross**
Heavy melting steel	18 00	18 00
Boiler plate	15 50	15 00
Axles (wrought iron)	22 00	20 00
Rails (scrap)	18 00	18 00
Malleable scrap	25 00	25 00
No. 1 machine east iron	32 00	33 00
Pipe, wrought	12 00	12 00
Car wheel	26 00	26 00
Steel axles	22 00	20 00
Mach. shop turnings	11 00	11 00
Stove plate	26 50	25 00
Cast boring	12 00	12 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜-in. and less	10
Carriage bolts, 7-16 and up	Net
Coach and lag screws	25
Stove bolts	55
Wrought washers	45
Elevator bolts	Net
Machine bolts, 7/16 and over	Net
Machine bolts, ⅜-in. and less	15
Blank bolts	Net
Bolt ends	Net
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square, blank	add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 50
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	25 and 5
Sq. and hex. hd. cap screws	22½
Rd. and fil. hd. cap screws... plus	17½
Flat but. hd. cap screws .. . plus	30
Fin. and semi-fin. nuts up to 1-in.	20
Fin. and Semi-fin. nuts, over 1-in., up to 1½-in.	10
Fin. and Semi-fin. nuts over 1½ in., up to 2-in.	Net
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws ....list plus 20,	30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$60 00
Open-hearth billets	60 00
O.H. sheet bars	76 00
Forging billets	56 00-75 00
Wire rods	52 00-70 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 70
Cut nails	5 85
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¾
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 35½
British Manila rope	0 28
New Zealand hemp	0 28
Transmission rope, Manila	0 47
Cotton rope, ¼-in. and up	0 88

POLISHED DRILL ROD

Discount off list, Montreal and Toronto .... net

Canada's Leading Tool House

Aikenhead's

Quality Tools for All Purposes

Johansson Adjustable Limit Snap Gages

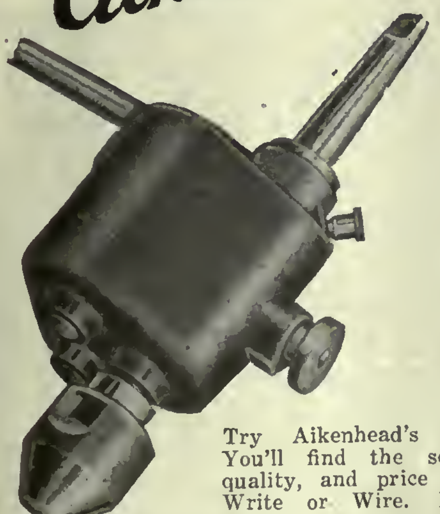
In manufacturing plants where economy and efficiency is keenly studied, there you will find Johansson Adjustable Snap Gages. Their remarkable success is due to two great factors—they make short cuts to production and cut manufacturing costs. In these days, when production costs are extremely high, every minute wasted by the mechanic eats up the profit and Johansson tools become an important essential of shop equipment. Johansson Adjustable Limit Snap Gages eliminate the cost of making and maintaining solid snaps. They eliminate the tendency of the operator to work to "absolute dimension" and get results, even in the hands of unskilled operators.

The Johansson book tells all about them. Write for your's to-day.

Aikenhead Hardware Limited
17, 19, 21 Temperance Street
Toronto, Canada

Johansson Gages are emblematic of Aikenhead quality in tools. Buy your tools at Aikenhead's.

Aikenhead's



Try Aikenhead's tools. You'll find the service, quality, and price right. Write or Wire. Immediate shipments on all orders.

Wahlstrom Automatic Tapping Attachment

Why stick to the old slow and expensive practice of Hand tapping when you can do the same work in one-tenth the time with a Wahlstrom Automatic Tapping Attachment? It imitates the simple to-and-fro motion of hand tapping and will tap holes as squarely as they could be drilled.

The Wahlstrom is constructed of hardened and ground parts and has nothing whatever that can get out of order. Attached to any type of drill press this Wahlstrom device will pay its cost in short order. It is made in two sizes. No. 1 takes taps of all sizes from 5.40 to ½ inch standard. No. 2 takes taps from ¼ inch to ¾ inch.

You can get the Wahlstrom at Aikenheads. Send for our free trial offer.

AIKENHEAD HARDWARE LIMITED
17, 19, 21 TEMPERANCE STREET, TORONTO

MISCELLANEOUS

Solder, strictly	$ 0 40
Solder, guaranteed	0 43
Babbitt metals	18 to 70
Soldering coppers, lb.	0 62
Lead wool, per lb.	0 16
Putty, 100-lb. drums	8 30
White lead, pure, cwt.	20 00
Red dry lead, 100-lb. kegs, per cwt.	16 50
Glue, English	0 40
Tarred slater's paper, roll	1 30
Gasoline, per gal., bulk	0 35
Benzine, per gal., bulk	0 35
Pure turp., single bbls., gal.	3 60
Linseed oil, raw, single bbls.	3 00
Linseed oil, boiled, single bbls.	3 03
Sandpaper, B. & A.	List plus 43
Emery cloth	List plus 37½
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin, "D," per lb.	0 14
Borax crystal and granular	0 14
Wood alcohol, per gal.	2 70
Whiting, plain, per 100 lbs.	2 75

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes	32½
Can. carbon cutters, plus	20
Standard drills, all sizes	32½
3-fluted drills, plus	10
Jobbers' and letter sizes	32½
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	net
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus 20 to	40
Can. high speed cutters, net to plus	10
American plus	40

COLD ROLLED STEEL

[At warehouse]

Rounds and squares	$7 base
Hexagons and flats	$7.75 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	60	75
Class B	27	37
Class C	18	27

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 8 50	$ 9 50
Sheets, black, No. 10	8 50	9 00
Canada plates, dull, 52 sheets	8 50	10 00
Can. plates, all bright	8 60	9 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	11 00	....
Fleur-de-Lis, 28 B.W.G.	10 50	....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28, U.S.	11 50	10 50
Premier, 10¾-oz.	11 50	10 90
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅞ in., $9.20; ¾ in., $9.30; ⅝ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	29 50
1¾ in.	31 50	30 00
2 in.	35 00	30 00
2¼ in.	35 00	29 00
2½ in.	42 00	37 00
3 in.	50 00	48 00
3¼ in.	.. ..	48 50
3½ in.	63 00	51 50
4 in.	85 00	65 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	....
Royalite, per gal., bulk	24½
Palacine	27½
Machine oil, per gal.	43½
Black oil, per gal.	18½
Cylinder oil, Capital	82
Cylinder oil, Acme	70
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	$2 60
Union thread cutting oil, antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil, bbls., net	13½

BELTING—No 1 OAK TANNED

Extra heavy, single and double	10%
Standard	10%
Cut leather lacing, No. 1	2 75
Leather in side	2 40

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 60
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	09
Pumice, ground	06
Emery glue	30
Tripoli composition	09
Crocus composition	12
Emery composition	10
Rouge, silver	60
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE

XXX Extra	.24	Atlas	.20
Peerless	.22½	X Empire	.19½
Grand	.22½	Ideal	.19
Superior	.22½	X Press	.17½
X L C R	.21		

Colored

Lion	.17	Popular	.13
Standard	.15	Keen	.11
No. 1	.15		

Wool Packing

Arrow	.35	Anvil	.22
Axle	.28	Anchor	.17

Washed Wipers

Select White	.20	Dark colored	.09
Mixed colored	.10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades... 15%

ANODES

Nickel	.58 to .65
Copper	.38 to .45
Tin	.70 to .70
Zinc	.18 to .18

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10.		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6 x 4 base	45 00	44 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 75	$14 50
Sheets, 3½ lbs. sq. ft.	10 50	14 00
Sheets, 4 to 6 lbs. sq. ft.	10 25	13 50

Cut sheets, ½c per lb. extra.

Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .23
Acid, hydrochloric	.03¼
Acid, nitric	.10
Acid, sulphuric	.03¼
Ammonia, aqua	.15
Ammonium, carbonate	.20
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, annhy.	.41
Copper, sulphate	.16
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.08
Nickel carbonate	.32
Nickel sulphate	.19
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.25
Silver nitrate (per oz.)	1.20
Sodium bisulphate	.11
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.18
Tin chloride	1.00
Zinc chloride, C.P.	.30
Xinc sulphate	.08

Prices per lb. unless otherwise stated

INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES

TRADE GOSSIP

Want to Buy Crane.—Fried Bros., Glace Bay, N.S., are in the market for a second-hand locomotive crane, capacity 15 to 20 tons, standard gauge.

Incorporation has been granted to the Easy Washing Machine Co., Ltd., of Toronto, capitalized at $400,000, to manufacture and deal in machinery and parts and accessories.

More Buying.—This year the Canadian National Railways rolling stock will be increased by the building of 5,750 freight cars, 80 locomotives, and 70 passenger coaches. The additions to the rolling stock, contracted for in 1919, are now almost completed.

For Ship Steel.—The Davie Shipbuilding Corporation of Levis, Que., a subsidiary of the great British Empire Steel and Iron Corporation, has taken options on lands situated in Lauzon with the intention of building in a year a huge establishment destined to prepare steel and iron for the construction of ships.

Better Shipments.—Freight conditions at Buffalo have improved in the last few days. The Pennsylvania Railroad are undertaking to relieve the congestion of cars in its yards at Buffalo to provide a freer movement of coal. About 150 trainmen were brought into Buffalo from other points and are working in the yards. Coal shipments were reported to be coming into Ontario in fairly regular quantities by the Grand Trunk. On one day 159 cars of soft coal and 108 cars of hard coal were brought into Toronto..

The first of the two blast furnaces which have been under construction at the River Rouge plant of the Ford Motor Co. was put in operation Monday, May 17, when Henry Ford, holding in his arms Edsel B. Ford's three-year-old son, Henry Ford III, helped the child light a match and fire oil-soaked excelsior, which touched off the charged stack. The 500 tons of pig iron which henceforth will be produced daily, will be increased to 1,000 tons daily when the second furnace is put in operation.

Short of Coal.—The soft coal situation in Guelph is becoming more serious every day, and if coal does not come in more freely during the next few days some of the local factories may have to close down until they can secure a supply. There are one or two factories that have a fairly good supply on hand, but they are conserving it in every possible way in order to make it last. The city waterworks department has only a very small supply, and it has already used up three cars of wood. The gas department has sufficient for several weeks.

Coming Back to Canada.—Building trades mechanics who crossed to England following the armistice, in considerable numbers, are coming back to Canada, according to John Cottam, secretary of the Toronto union of carpenters. "Each steamship arrival brings old members back along with a number of new faces. They all tell the same story," said Mr. Cottam. "They say that work is plentiful in the skilled trades, but that living is very high and that the housing problem is very serious."

Returning to Work.—Men at the Keating's foundry, Toronto, who have been on strike for several weeks, have returned to work. They have been granted a five cent increase upon the wages they were receiving a few weeks ago, the increase to be retroactive to May 1, and a further increase of five cents to be granted on August 1. Agreements have also been signed with the brass workers at the Monarch and Standard Sanitary Foundries. Other firms are still negotiating with the Machinists' Union respecting increases.

Motor a Failure.—Sequel to the remarkable furore over stock of the P. Lyall & Sons' Construction Company because of the remarkable motor engine said to have been tested out by them some months ago, comes in the annual statement of the company, which says: "The automobile engine with which your company experimented was tested by experts, whose reports do not offer sufficient encouragement to undertake its

DISPOSAL OF ROSS RIFLE PLANT SPOKEN OF IN OTTAWA HOUSE

QUOTATIONS asked and answered in the Dominion House a few days ago, have a peculiar interest for the Canadian machine tool trade and manufacturing interests generally. Mr. Bureau was the questioner, and the replies were supplied by the Hon. Hugh Guthrie:

Q. What was the inventory value of the machinery in the Ross rifle factory at Quebec when taken over by the Government?

A. The Canadian Appraisal Company made inventory values as follows:

Reproductive value $875,000
Sales value $500,000

Q. What amount has been received from the sale of this machinery up to the end of the last fiscal year?

A. Approximately $400,000.

Q. Was said machinery and other physical assets of the plant disposed of by public tender, through commission agents or by private sale?

A. The means adopted for the sale of the machinery and other assets of the plant were intended to meet conditions as they occurred, and are as follows:

(a) By the circulation of printed lists;
(b) By advertising;
(c) By assistance from machinery firms;
(d) By personal calls and correspondence.

Q. What method is being adopted at present in regard to the disposal of machinery on hand?

A. Machinery now being sold as in "3" above, and in accordance with a price list.

Q. Who is the officer in charge, where and on whose recommendation was he appointed?

A. Mr. W. S. Fisher is the commissioner in charge, and was appointed by Order-in-Council in April, 1917.

Q. What prior experience has he had in regard to the valuation and disposal of machinery?

A. He has wide business experience in foundry and hardware business.

Q. Has the Government a special auditor at the plant to check up prices, methods of sale and amounts received from the assets disposed of?

A. No. Systematic auditing is carried out by departmental auditors, and a special audit on the premises is made periodically.

Q. Is it true that some of the machinery in the plant has been broken up and sold as scrap metal instead of being sold intact at present market value?

A. Yes. A few special machines have been broken up and sold as scrap. However, these were of special design for the manufacture of Ross rifles, and, being absolutely useless for any other purpose, were unsaleable.

If interested tear out this page and place with with letters to be answered.

manufacture." There has been a large decrease in earnings during the first year of reconstruction, but President William Lyall says: "Your company has been fortunate in securing several large contracts, in addition to those already in hand, and your directors look forward with confidence to the future."

Sues for Commission.—J. Wesley Allison, of Morrisburg, Ont., who figured in the famous fuse inquiry at Ottawa in 1916, is now appearing as plaintiff in a suit in New York that is also based on munition contracts. Suit for $300,000 based upon a British munitions contract was filed in the United States District Court here this afternoon by Colonel Allison against H. M. Dodge, of Madison, N.J., director of the Remington Arms-Metallic Cartridge Company. Allison claims the amount as commission due him on a contract for more than 2,000,000 shells. He alleges that he obtained plans and specifications for the cases, furnished them to Dodge, and gained from Sir Sam Hughes, Minister of Militia and Defence of Canada, "directions to proceed with the manufacture of the tools."

PERSONAL

Official announcement was made that P. Merril has been appointed general manager of the Dominion Iron and Steel Company, and the Dominion Coal Company. Mr. Merril will reside in Sydney and will be in charge of all the operations of the two corporations and their subsidiaries.

EXPANSION CANADIAN BUSINESS MAY FOLLOW HALL-WILLIAMS MERGER

Some time ago CANADIAN MACHINERY presented an article to their readers on the plant of the John H. Hall & Sons, Ltd., Brantford, Canada. At the conclusion of this article we stated that business expansion was only a matter of time as far as we could see, and while we take no credit as to being prophets, our prognostication has come true nevertheless. This concern has now formed a merger with a well-known American pipe machine manufacturer, namely, the Williams Tool Corporation of Erie, Pa.

The John Hall Co. is too well known to require further introduction, but to those who are not familiar with the Williams Tool Corporation, we might state that they are one of the oldest and perhaps the largest manufacturers of pipe machines in the United States.

The Hall Co. have been so busy lately that a night shift has been necessary, and it was felt that something had to be done to meet the increasing demand for their machines and for prospective export orders, hence the merger. It is expected that in the very near future a new modern factory will be necessary.

The announcement of this merger will no doubt be of particular interest to the machinery houses in Canada, and the users of pipe threading machines in general. Both these concerns specialize on pipe machinery, and the new corporation will have a capitalization of close to one million dollars. The entire activities of the new company will be to produce the latest and best in their line. This will ensure that the present high standard of Hall products will not only be maintained but improved if possible. Machines will be manufactured in larger quantities, and it is hoped in the near future that the company will be able to ship from stock from their own warehouse. All standard stock parts and dies will be available for immediate shipment.

A special department of the new corporation will be the publicity or educational department. Attractive literature covering the various uses of pipe machines, as seen from the users' standpoint, will be covered. Charts will be shown and devices in actual practice. The cost of threading pipe and how to overcome lost production will be gone into. A service of instructive and educational circulars will be issued for the man on the machine, and the advice and experience of twenty years will be placed in these books and booklets.

The local plant of the concern will be known as the Hall plant of the Williams Tool Corporation, and several special high powered machines will be installed to speed up their present production.

Speaking to Mr. Leslie S. Hall, the president and general manager of the old company, regarding changes in positions, he stated that the personnel of the new concern would be as follows:

Mr. Brill, who will be president, is a consulting and manufacturing engineer of wide experience. Mr. Davis, senior member of Davis & Co., New York, will be chairman of the board of directors, while Leslie S. Hall himself will take over an executive position between the two factories and becomes vice-president. Mr. A. R. Hall will be manager of the local plant and Mr. E. L. Williams, will have charge of the local office. Mr. E. W. Hall is retiring as secretary and treasurer of the company, and Mr. E. L. Hall, who is now in England, will no doubt continue with the new corporation on his return.

This places the local branch in an enviable position as nearly all their present officers retain executive positions. "Still better machines and better education as to the use of our machines will be our motto," finished Mr. Hall.

Screw Pitch Gauge

The Greenfield Tap and Die Corporation of Greenfield, Mass., have made an improvement on the old-fashioned screw pitch gauge, in making the same into a limit gauge, which will increase the accuracy and enable the user to determine in which direction any error lies. One side of the gauge is cut to conform to the normal pitch of the thread, while the opposite side is divided into two sections, one of which is cut with a thread 0.002 inch long, and the other section 0.002 inch short per inch, thus giving a tolerance above and below the normal size.

ON THE TRAIL OF THE PROFITEER

—Reynolds in Tacoma "Register."

Dumore Grinders in the Delco Tool Room

BUSY, EFFICIENT, ADAPTABLE TOOLS

THE Dumore Grinders at the Dayton Electric Laboratory Company (Dayton, Ohio) are continually busy and the Delco tool makers surely like them. The job you see chucked in the heavy lathe is one of a lot of fine counterbores used in the production of distributor cams on Delco ignition sets. Fine limits are fixed on this job and the Dumore as an internal grinding machine has amply proven its dependability for the accurate grinding of duplicate diameters.

This is only one of the many uses made of Dumore Grinders. For all work where speed and production costs are to be considered—where accuracy is of prime importance—and also for the multitude of odd jobs that arise every day — Dumore Grinders are indispensable

Dynamically balanced, no end play, no vibration. Equipped with S. K. F. and Norma ball bearings. Well built, adaptable, efficient—Dumore Grinders cut costs throughout the shop.

WISCONSIN ELECTRIC COMPANY

2924 Sixteenth Street **RACINE, WISCONSIN**

DUMORE HIGH SPEED GRINDERS

RAILWAY SCRAP SHORTAGE

Continued from page 90

53. No. 3 spring steel. Coil springs made from steel under 3-16 inch in any diameter.

54. No. 1 cast steel. Charging box size, 5 ft. and under, under 18 in. wide; no piece weighing less than 10 lbs. to be included.

55. No. 2 cast steel. Over 5 ft. long and 18 in. wide.

56. No. 1 heavy melting steel. Charging box size, 5 ft. and under 18 in. wide; no piece weighing less than 10 lbs., including all steel scrap not otherwise specified.

57. No. 2 heavy melting steel. Over 5 ft. long and 18 in. wide; including all steel scrap not otherwise specified.

58. Tools and tool steel. Files and worn-out steel tools, including old claw bars, pinch bars, spike mauls, track wrenches, picks, adzes, axes, chisels, drills, hammers, knuckle pins, punches, tool steel, finger pins, bits, draft keys, bar steel, weighing 10 lbs. per piece.

59. No. 1 tires. All locomotive driving, engine truck and coach tires 36 in. and over inside diameter, smooth inside; not grooved for retaining rings.

60. No. 2 tires. All tires not included in No. 1.

61. No. 1 turnings and drillings. Wrot iron and soft steel, clean and free from cast borings, brass, hard steel, other metals, dirt and lumps.

62. No. 2 turnings and drillings. From tires and other similar steel, including hard steel; clean, free from other metal, dirt and lumps.

63. No. 1 turnings, drillings and borings. Wrot, cast and steel mixed; free from other metals, dirt and lumps.

64. No. 2 turnings, drillings and borings. Wrot, cast and steel, mixed with brass and other metals; free from dirt and lumps.

65. Wrot, No. 1 extra railroad. Rods and bars, 1½ in. in diameter and larger; 6 ft. and over.

66. No. 1 railroad wrot. Clean wrot iron, from railroad equipment, pieces measuring 4 in. long and over (exclusive of threads), may include rods and bolts ⅝ in. in diameter and over (except track bolts), also drawbar yokes, bridge iron in bars or rods, switch rods, heavy iron chains, links and pins; free from riveted material.

67. No. 2 railroad wrot. All wrot iron under 6 in. long not specified under No. 1; to include track spikes, bolts and nuts, rivets and lag screws.

Miscellaneous

68. Babbitt. Clean.

69. Barrels, oil. Standard classification.

70. Barrels, paint. Standard classification.

71. Bags and burlap. Bagging, sacking and waste covering.

72. Brick. Arch and fire brick.

73. Belting, leather. Including punchings and trimmings (specify width).

74. No. 1 brass. Locomotive brass, including rod brass.

75. No. 2 brass. Steam metal brass, including valve fittings.

76. No. 3 brass. Car journal bearings free from babbitt.

77. No. 4 brass. Brass borings, drillings and turnings.

78. No. 5 brass. Yellow brass castings, including hose couplings, etc.

79. No. 6 brass. Coach trimmings and light brass.

80. No. 1 copper. Wire, flue ferrules, pipe, hammer heads.

81. No. 2 copper. Sheet copper.

82. No. 3 copper. Roofing copper with paint and nails.

83. No. 4 copper. Battery copper, dross and oxide. Report separately.

84. Carpet, linoleum and plush. (Specify kind).

85. Crucibles, old.

86. No. 1 hose. Air brakes and signal hose free from wire and fittings, also rubber boots and shoes without leather soles.

87. No. 2 hose. Steam and water hose, free from wire end fittings.

88. No. 3 hose. Engine tank, washout, fire and rubber lined fire hose, free from wire and fittings.

89. No. 4 hose, wire wound hose and wire inserted. To also include oil and paint hose.

90. Rope. Manila fibre, not including tar rope.

91. Tarred rope and marlin.

92. No. 1 rubber. Rubber packing, gaskets, diaphragms, matting and step treads.

93. No. 2 rubber. Rubber valves of all kinds.

94. No. 3 rubber. Rubber belting of all kinds.

95. No. 1 wheels. Cast iron, including car, tender and engine truck; no allowance for grease and dirt.

96. No. 2 wheels. Steel tired; specify kind.

97. Wire, telegraph in rolls.

98. Zinc, sheet and battery.

*Structural covers building and bridge iron and steel. Shaped covers cars and pile driver iron and steel.

INDUSTRIES THAT ARE EXTENDING

Going Ahead With New Building in Order to Handle the Increasing Trade

The Draper Mfg. Co., Port Huron, will re-open and enlarge its plant at Petrolia, Ont., which was closed some time ago. It manufactures valve facing tools, ball check valves, ball globe valves, balanced brass balls, etc. Operations are expected to begin in about two months.

Beatty Brothers, Fergus, Ont., manufacturers of stable equipment, pumps, washers, etc., have increased their capital stock from $750,000 to $2,000,000 to provide additional capital to take care of increased business. It is the intention of the company to spend this year about $150,000 on additions and machinery. About 70,000 sq. ft. of floor space is being added to the Fergus plants and improvements are under way at the plants at London, Ont.

The Sherbrooke Machinery Co., Randrell Street, Sherbrooke, Que., has awarded the general contract to the Loomis Construction Co., 7 Belvidere Street, for an addition to its machine shop to cost $26,000.

Bert Marsh, Auburn, Ont., will rebuild his sawmill recently destroyed by fire and is asking for prices on equipment.

The Berliner Gramophone Co., St. Antoine Street, Montreal, has awarded contracts for the erection of a factory costing $400,000. The Atlas Construction Co., 37 Belmont Street, has the contract.

The Atlas Mfg. Co., Port Arthur, Ont., manufacturer of electrical supplies and equipment, automobiles, etc., has recently purchased property on Ambrose Street and is remodelling a building on the site. It also intends to erect a four-storey brick structure for which machinery will be purchased. W. L. McGregor is president; A. G. Day, vice-president, and A. C. Latoski, secretary and general manager.

Montreal Notes

G. J. Desbarats, Deputy Minister of Naval Service; Thos. Robb, of the Shipping Federation, and C. J. Gauthier, sailed from New York last week on the Cretic to attend the Seamen's International Conference, which is being held at Genoa this month.

The St. Lawrence Welding Company, of 138 Inspector Street, Montreal, has secured the manufacturing and selling rights for the Simplex collapsible rims for automobiles. In addition to the making of the new rims they will manufacture the attachments for the converting of old rims.

The new addition to the plant of the St. Lawrence Welding Company has been completed and new machinery has been installed. A set of 8 ft. bending rolls, capable of handling 1-inch plate, has been added to the equipment. Several new machines have also been provided in the machine shop.

At the annual meeting of the Montreal branch of the Engineering Institute of Canada held last week, Arthur Surveyor was elected chairman for the ensuing year. In addition to the election of officers, a corporation of professional engineers was formed, and the council for the present year of this new section will be A. R. Decary, president; W. J. Francis, vice-president, and F. R. Brown, honorary secretary-treasurer.

If interested tear out this page and place with with letters to be answered.

REGARDING MOLYBDENUM

(Continued from page 531)

of the other ingredients alloyed. The rolling mill yield is also higher and the cost of grinding less.

"Most marked results are obtained in the forming of the steel. To illustrate, the forging temperature can be carried considerably higner than is ordinary without fear of destroying properties hitherto unreclaimably lost if the temperature exceeded the allowable narrow limits. In other words, the forging can be done at a higher temperature without burning or over-crystallizing the steel, and this results in cutting down the forging operations because the metal is more plastic, and it also eliminates the losses heretofore frequently occurring for the reason that the allowable limits of forging temperature were exceeded during the forging, because of inability to maintain uniform temperature regulation, particularly where articles are being produced in large quantities. An additional saving is effected by virtue of the fact that with such wider range of forging temperature, the use of the expensive regulating equipment and operators is obviated, because the furnace men can readily approximate the temperature within much less than 200 deg., merely by the color of the metal.

"Again, the range of temperature for heat treatment is greatly increased, and instead of being confined within 10 deg. to 20 deg. Fahr. as is the case with present commercial alloy steel, the temperature range is increased to about 200 deg. Stated in other words, the molybdenum prevents detrimental structural changes, such as crystallization, and secondary chemical reactions from taking place until the temperature goes several hundred degrees above the point of recalscence. This is an advantage of the greatest importance, not only because of the saving effected in the cost by the elimination of furnace regulating equipment, but also because the metal will run uniformly under wide variations in temperature, which means that the losses in manufacture and in service, ordinarily attributable to exceeding the narrow range of heat treatment, are reduced to a minimum, if not entirely eliminated. In other words, it is possible to manufacture machine parts, for example, on a large scale and obtain uniform results notwithstanding the impossibility of maintaining uniform temperature conditions.

"Furthermore, it appears that the qualities of the steel after forging are far superior than is ordinarily found to be the case, so that it is possible, if desired, to eliminate the normalizing heat preceding the quenching heat. In so far as the drawing heat is concerned, the use of the molybdenum makes it possible to draw at a much higher temperature, which effects a saving because it is much easier to regulate a furnace at high temperatures than it is at low temperatures.

"As to workability after heat treatment, I find that alloy steels made in accordance with my invention have excellent machining characteristics, having the ease of workability of vanadium steel combined with the superior non-crystallizing characteristics of the nickel steels.

"The physical properties of the steel, in contra distinction to ordinary commercial alloy steels, very closely approximate the super-excellent properties of the special steels. Thus, the tensile strength and the elastic limit are greatly increased, while a maximum elongation is obtained. The cost to obtain like results with the nickel and the vanadium steels, even assuming that no result detrimental to other properties would follow, would be prohibitive. The steel also has a very high resistance to impact and shock, and to alternating stresses without crystallization, the reduction in area is excellent, and the steel can be cold bent double or twisted a number of times without developing flaws. It appears that by the use of molybdenum in small quantities the increase in the physical properties is ob- molybdenum materially increases the depth of hardening, so that the above properties will be found even where considerable reductions in cross-sectional areas are made during manufacture. Certain of these properties flow from the fact that the increased temperature range permits of forging, quenching and drawing at a higher temperature; and others from the direct chemical effect and the indirect chemical effect of the molybdenum."

TRADE GOSSIP

Trouble at Peterboro.—The Canadian General Electric machinists' at Peterboro offer to the company to abide by the recommendations of the Board of Conciliation authorized by Senator Robertson, Minister of Labor, brought the following reply from Senator Nicholls to Mayor McIntyre: "The company declines to be represented on a Board of Conciliation in connection with the strike in Peterboro, and must also decline to accept any award of such board if appointed. We are still willing to grant the increases which were offered to the men before going on strike. We have advised the Minister of our decision." It was followed by another telegram, which simply reiterated Senator Nicholls' determination not to yield to the demands of the men.

Get-Together Meeting.—Friday evening the management and the employees of the P. B. Yates Machine Company, Limited, Hamilton, held their first annual "get-together" social and entertainment in the Sons of England hall, Hughson street north, when about three hundred of the employees and their friends attended. The entertainment commenced about 7.15, in the form of a euchre and whist drive, concert, supper and dance. The company had also prepared a fine softball diamond, and the team of the Yates company will be glad to arrange a game with any of the other factories. There is also a fine soccer and quoits field for the employees. For some time past there has been a steady growth of the community spirit in the firm.

CANADIAN MACHINERY
AND
MANUFACTURING NEWS

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Vol. XXIII., No. 24 June 10, 1920

Various Machine Operations on Beveled Shoe

Practical Men in General Will Welcome This Article Describing Interesting Problems Met with in the Machining of This Shoe—Both Milling and Drilling Work Are Entailed.

by F. SCRIBER

A RATHER interesting problem presents itself in the machining of the part shown completely finished in the lower right-hand corner of Fig. 1. This is made of steel and has both ends bevelled, these running tangent to a common centre from which the inner and outer radius is swung. This part is one of a number cut out of the ring illustrated at the left, the cutting out operation being performed with the work set on a suitable angle, so the work will look as shown in the upper right-hand corner of Fig. 1 after the operation of sawing apart.

In considering this piece the first operation determined upon was to forge up steel sleeves of suitable length and diameter, these to be held in a chuck on the lathe while bored, turned and cut off into rings such as are shown. Following this in succession the shoes are cut from the ring—the holes are drilled—one end is milled, followed by milling of the opposite end, after which the lips on the side of the bevelled ends are milled.

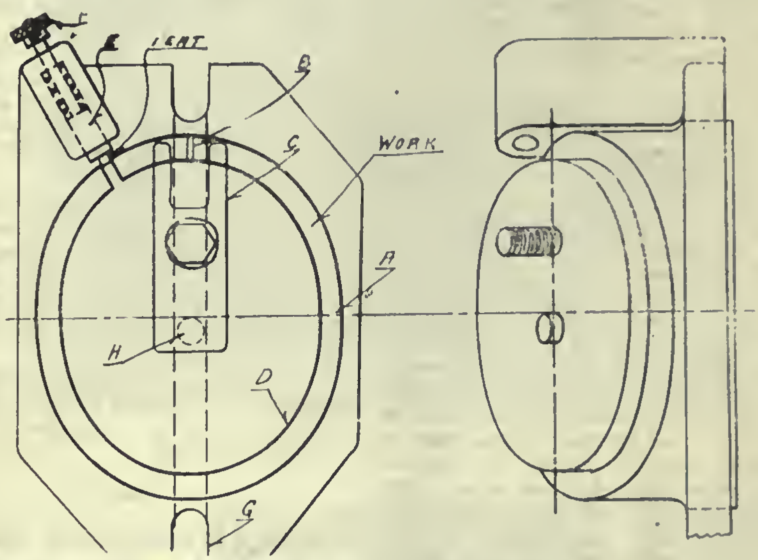


FIG. 2—FIXTURE FOR SAWING SHOES APART.

Referring to Fig. 2. Here is shown the fixture in which the blank shoes are cut from the ring. It will be noticed in this connection that the ring A is held on an angle so the ring will be cut apart diagonally. The first cut is made as indicated by the two lines B, the work being held in place by clamp C, it being obvious that the ring is centralized by the diameter D on the fixture. At this time spring pin E has been pulled back by means of the knurled knob F, to allow the ring to be put in place, and after the first cut is made the ring is revolved on its seat (the clamp being loosened to permit of this) until the teat on the end of the spring pin enters this slot, thereby indexing the ring correctly for making the next cut and thereby permitting the severing of the first blank. Continuing this operation of revolving the ring, using the spring pin as a stop, clamping the ring and sawing through

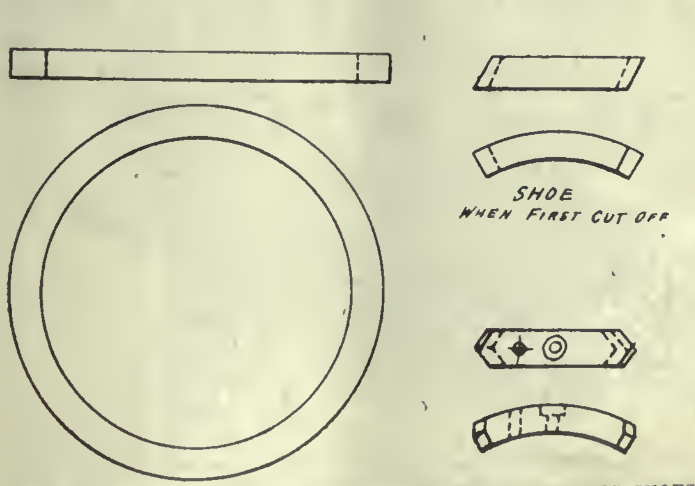


FIG. 1—LAYOUT SHOWING OPERATIONS WHEN MACHINING SHOES.

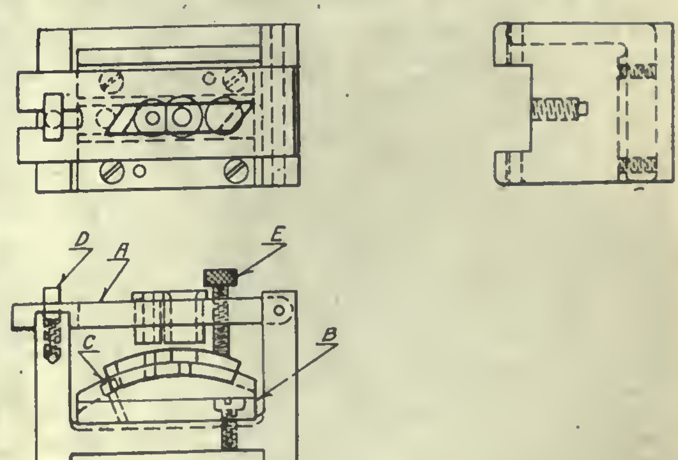


FIG. 3—THE JIG FOR DRILLING OF TWO HOLES.

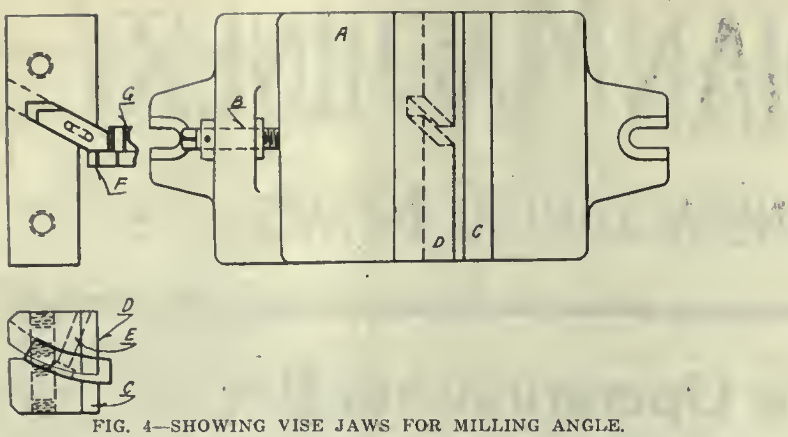


FIG. 4—SHOWING VISE JAWS FOR MILLING ANGLE.

the ring successively, the entire ring is cut into the necessary blanks from which the shoe is made. Slots G are used for holding down bolts to clamp this fixture to the table of the machine, while shouldered pin H is used under the end of the clamp, thereby causing the clamp to bind equally both sides of the ring near the cut.

For convenience in locating the work during the operations which are to follow the next operation is to drill the small hole and also to drill and counterbore the screw hole, all of which is performed in the jig shown by Fig. 3, which is operated as follows: With hinge cover A swung back out of the way the work is placed as shown in the grooved block B, which locates it sideways, while it is located against the pin C for endwise location. The hinge cover is then swung into position, it being locked in place by the quarter turn screw D. Knurled screw E is then used for holding the work in position, while the holes are machined in the usual manner, using a spot drill, reamer size drill and reamer for the small hole, while the other hole is spotted with a counterbore size drill, drilled with a screw size drill and counterbored, this being standard practice where a good degree of accuracy is required without the use of slip bushings.

It would perhaps be hard to devise a simpler method of handling this shoe in a cheaper manner than to use a special set of vise jaws, and while this cannot be termed a speedy operation it is very efficient, reference to Fig. 4 clearly indicating the method of handling at this time, it being necessary to mill both surfaces at one end, following which the work is turned end for end, while the other two surfaces are milled.

The vise proper A is of a standard make in which the movable jaw is operted by screw B. The two jaws C and D are special, being made to accommodate this job only; jaw C is shaped to conform to the outer radius of the work, while jaw D is curved so there will be no interference, and is also grooved to locate the work sideways, a pin E in the screw hole of the work being employed to locate it radially. With the work clamped in the position shown, by operating the vise in the usual manner two cutters F and G are caused to mill both surfaces (which are at right angles to each other and at an angle of forty-five degrees to the centre line of the work) at the same time. Reversing the work and proceeding to hold and mill it in the same manner is all that is necessary for machining the other end.

Fig. 5 illustrates a milling fixture for performing the final operation, that of milling the lips on the ends of the work. This fixture is very simple, inasmuch as two parts, A and B, are placed as shown over pins C and D, and are clamped by strap E through the medium of the stud F and nut and washer G.

It will be noticed in this connection that opposite ends of the work are milled at this time on two separate parts, therefore at each pass of the cutter it is equivalent to completing one shoe, the work being fed under the cut in the direction of the arrow.

No attempt was made to get maximum production from these fixtures, it simply being advisable to get duplicate work in moderate quantity.

INTERESTING FACTS TO BE FOUND IN THIS WEEK'S ADVERTISING SECTION

All about a certain attachment that hangs on to every speck of dirt and muck it comes in contact with.

A machine whose cutter removes metal 90% of its actual working time.

All about certain equipment that saves time, labor, and money.

A mark to look for, that, although inconspicuous, is very significant.

What one firm considers the best thing they make.

Numerous requests that you write and secure valuable information.

That extensive experience is bound to show results.

What to do if a bad nut gets loose.

How one can increase his batting average without even playing baseball.

A machine tool builder that emphasizes fourteen points in his product.

That production is something that depends on your equipment.

That low cost of maintenance is a very important feature.

That it pays to be interested in cutting drilling costs.

That gauging is an expensive operation.

How to cut cutting cost.

That the location of an industrial plant has a vital effect on its prosperity.

SEAM WELDING MADE PERFECT

A vital improvement in the process of "seam welding" by electricity has been made by a British firm of engineers. In this process, as usually carried on, two thin sheets of iron are held together between rollers which carry the welding current, and are moved continuously as the welding proceeds. The metal at the joint must be thoroughly cleaned beforehand, as any scale on the surface melts before the iron and causes the rollers to slip. Another disadvantage is that the welded portion passes on in a half-molten state and is liable to open before the metal sets. In the new machine the process is made intermittent. The rollers grip the sheets in the same way, but as soon as the welding current passes and fuses the metal it is switched off, and the rollers give the work a squeeze, making a firm weld. After a short interval which gives the weld time to set, the rollers move the work a little, current is switched on, another weld is made, and the same process is repeated. Thus a series of overlapping spot welds is produced, forming a continuous water-tight weld. With this machine there is no need to spend time and money in preliminary cleaning of the metal. The serious of actions is effected by the simple automatic mechanism. Most successful results have already been achieved by this invention.

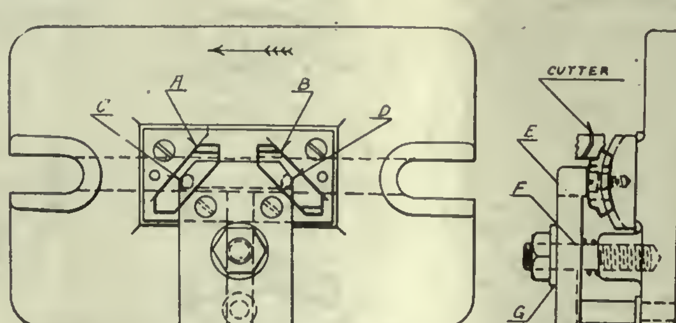


FIG. 5—FIXTURE FOR MILLING LIPS ON SHOES.

Are You Anxious to Increase Your Production?

Believing that Everybody is Scrambling After Increased Production, We Have Compiled Some Interesting Data on a Recent Machine Tool Development—Examples of Work Performed Are Also Given.

By J. H. MOORE

WHILE the article to follow will discuss and describe a certain type of lathe, this does not infer that it is intended as a new equipment notice only. The intention is twofold first, to acquaint designers in general regarding the main points in this machine's design; and second, to place before the practical machinist the possibilities of this type of lathe. The machine under consideration is that of the Multi-Cut lathe, as manufactured by the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio.

As they remark, "Multiple cutting is cost cutting." In these days of keen competition, this feature of cost cutting is a big consideration. What everyone desires is production, and to obtain this condition, we must eliminate every possible leak. It is only by so doing that we can hope to reach maximum efficiency.

The general trend in the machine tool field has been towards "special machine for special work," or in other words, "Definite service machine tools."

Description of Machine

One of these departures is found in the LeBlond Multi-Cut lathe, for this tool has certainly been built for definite service. To get acquainted with its general appearance let us refer to Figs. 1 and 2.

This lathe is of the semi-automatic type, on which one or more facing and

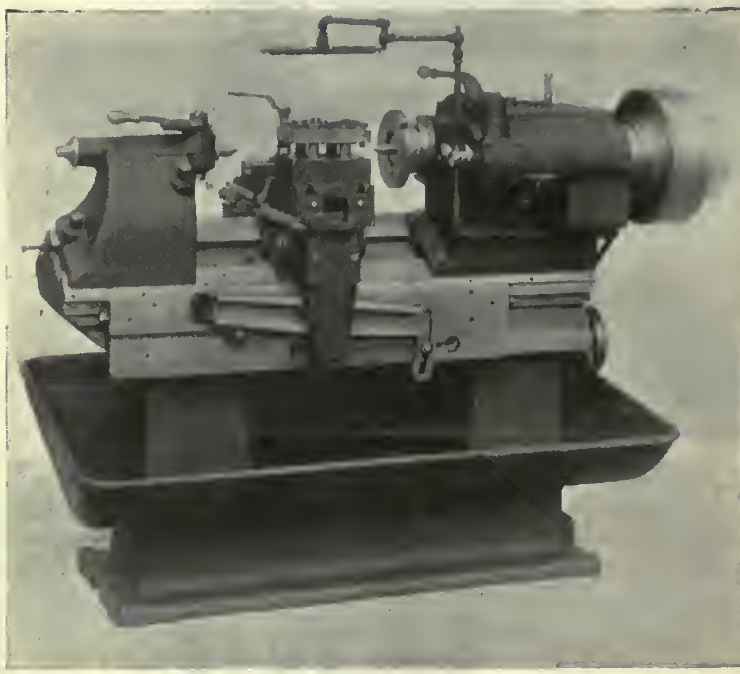
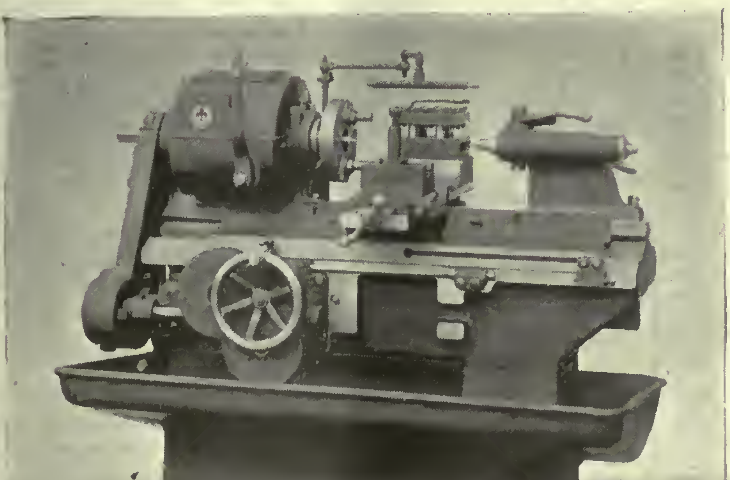


FIG. 3—A REAR VIEW SHOWING THE FACING ATTACHMENT.



GENERAL VIEW OF THE LATHE.

FIG. 2—AN END VIEW SHOWING VARIOUS POINTS OF CONSTRUCTION.

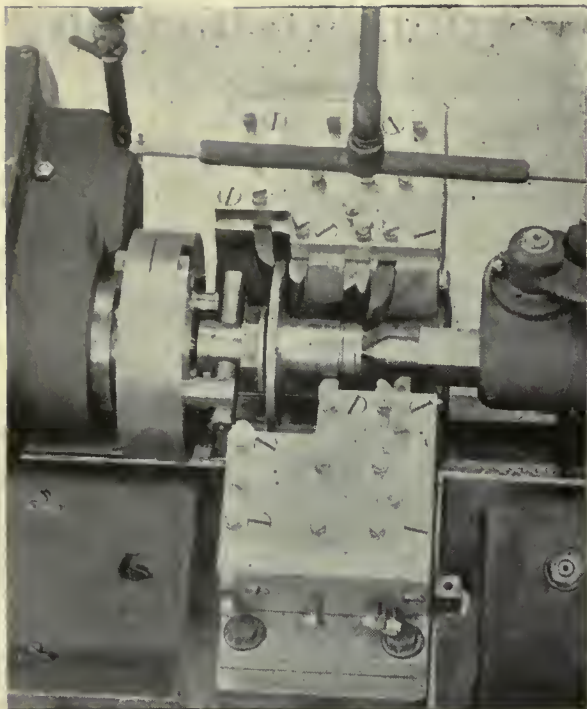


FIG. 4—A TYPICAL TOOL SET UP.

turning operations can be performed simultaneously; one operator running one or more machines. Various drives and equipment can be provided, this feature allowing it to be used in any industry having duplication work to perform.

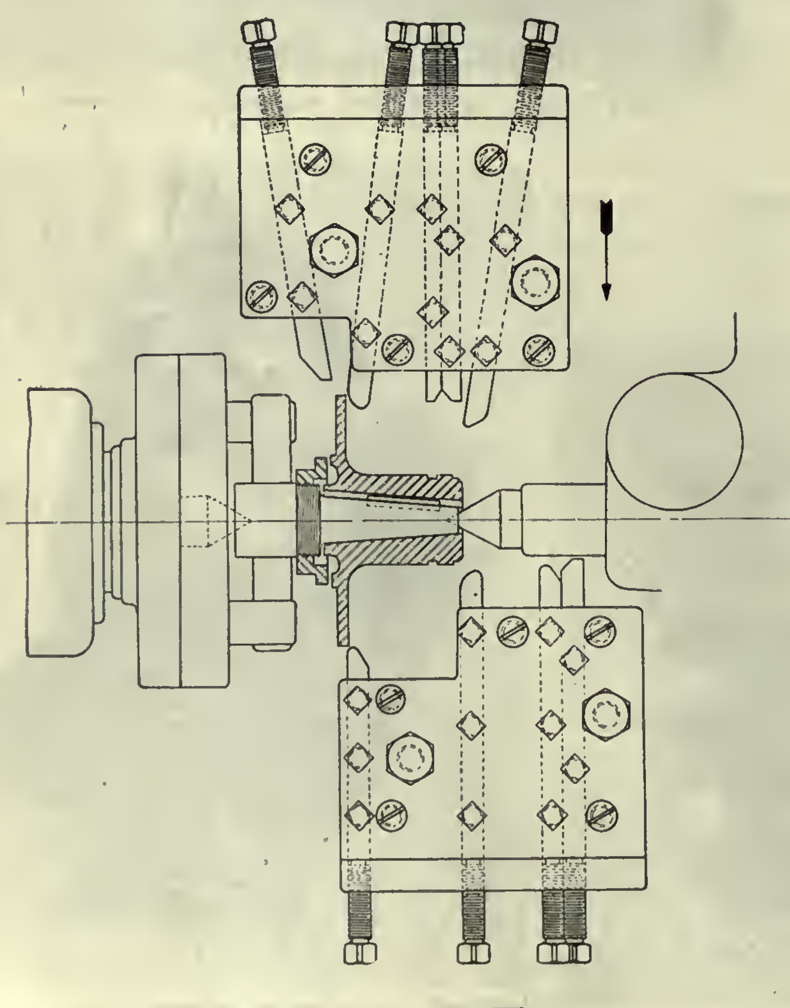


FIG. 5—DIAGRAMMATICAL VIEW OF SET UP SHOWN AT FIG. 4

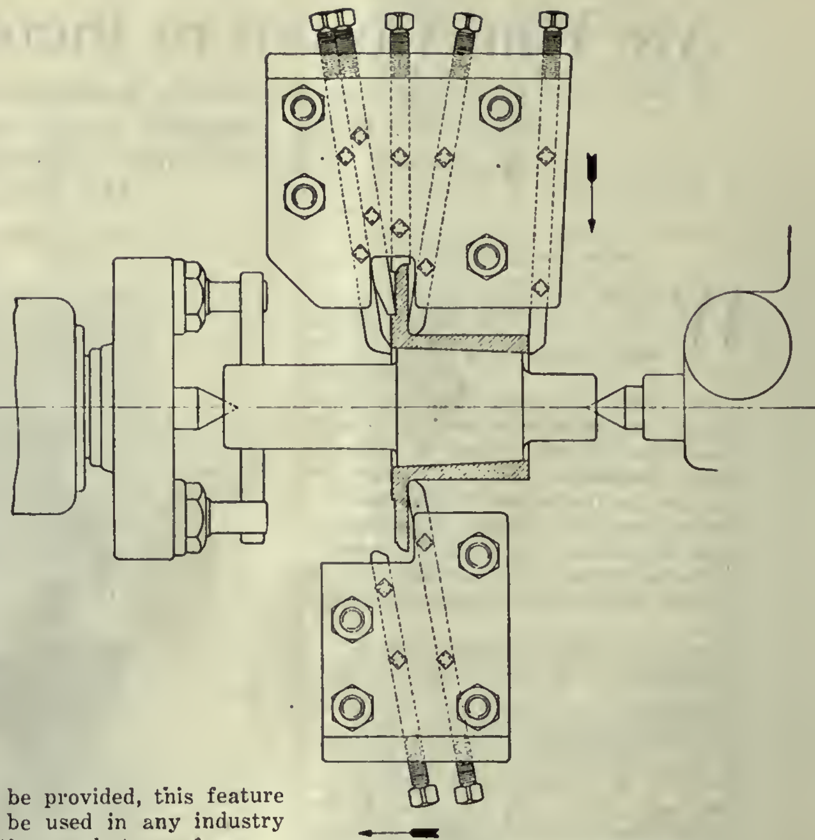


FIG. 6—TURNING, FACING, AND FLANGING OF AUTOMOBILE WHEEL HUB.

The work itself may be centered, held on arbors or expansion chucks of either pneumatic or hand-operated design on work that has been previously bored, reamed, or rough turned on the turret lathe or automatic, this machine fits in ideal for finishing purposes. Finish turning and facing are accomplished very rapidly. This makes the machine very useful in finishing gear blanks, cone pulleys, bevel gears, pistons, steering punches, cam shifts, etc., etc. Of course, the lathe is not confined to finishing work only, but owing to its rapid action, it is especially useful for such class of work.

As the word multi-cut signifies, many tools, are used at once. The tools however, are of the lathe type, simple and inexpensive, so that the upkeep of tool equipment is not a large item. The machine is easily set up, there being no cams, either fixed or adjustable to consider. Having described the uses of the lathe let us proceed with its general design.

General Design

The machine is built in two sizes, No. 6 and No. 9. The former of these has a 6 inch swing, and 10 inch capacity between centres, while the latter has a 9 inch swing and a 16 inch capacity between centres. Both sizes are built with two types of headstock, named F and D. The first style may be motor driven by either alternating or direct current, and is of the selective speed type, providing 6 speed changes through sliding gears from a constant speed driving pulley. This permits of speed variation sufficient

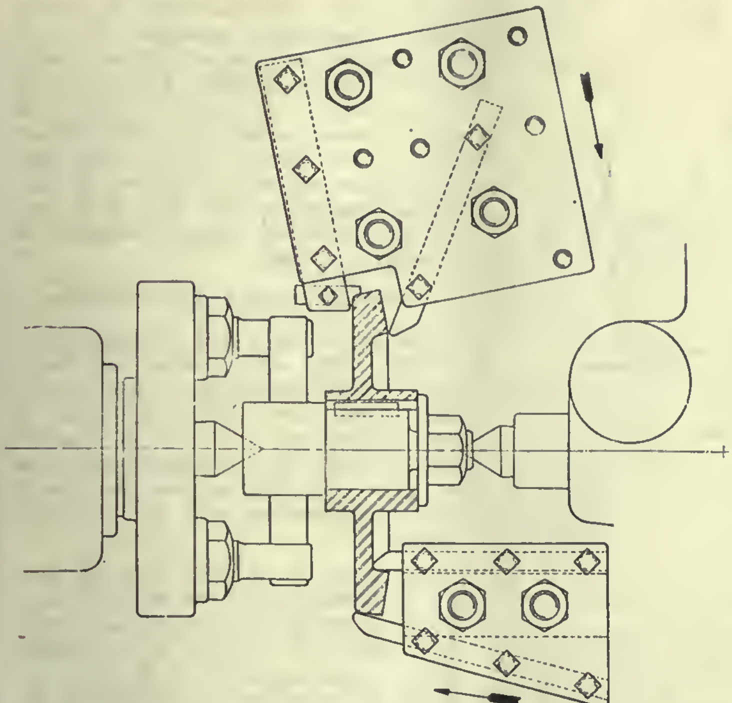


FIG. 7—VARIOUS OPERATIONS ON A CAST STEEL BEVEL GEAR.

) cover all classes of work. If desired ie headstock can be made with right ngle drive.

The style D headstock is of the single peed open belt head type. It is proided with a lever operated friction start, top and brake. The pulley on this eadstock is accurately balanced, peritting of speeds up to 1,000 r. m. p. his, of course, makes it especially daptable on brass, bronze and aluminm work.

The friction clutch is mounted in the eriphery of the driving pulley, and is f the double finger, wedge acting type, eing adjustable for tension, and balnced against rotative forces. A brake mounted on the spindle, bringing it to n instant stop when clutch is released, spring tension holding it into the brake, reventing accidental starting.

The spindle bearings are renewable bronze boxes, babbitt lined and provided with sight feed oilers. The thrust is taken up by ball thrust bearings. This style head is intended to be driven direct from the line shaft, but should this be impossible, jack shafts can be provided.

As the class of work accomplished by these machines is so varied, the equipment provided is optional, and is supplied to meet with the requirements of the work.

A statement of the attachments possible, however, will be well worth while. Plain or universal facing attachments, taper attachment, compound or plain block rest, draw-in attachment with collet special forming attachment, and in fact any special tool and chuck equipment can be provided. As the lathe is really a definite service machine, the tooling is arranged to suit the work, aiming at the turning it out at maximum speed.

Referring to Figs. 1 and 2, it will be noted that the bed is of anvil section, with broad slides for the carriage, bearings, head, and tailstock. These are so arranged that the pressures resulting from the cut tend to force the slides more firmly to a bearing. The slides are very broad and are provided with dovetail guiding shears. These are tapered gibbed and prevent and lifting tendency.

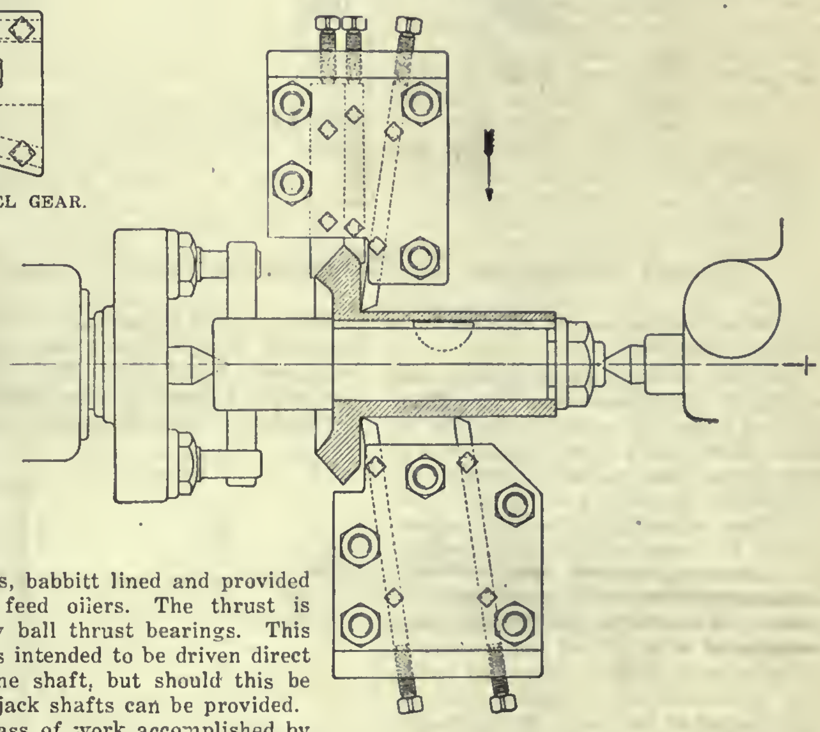


FIG. 9—MULTIPLE TOOLING USED ON TRANSMISSION SHAFT.

The bed is strongly ribbed, and contains a pan for cutting compound in its interior. This pan in turn is provided with a strainer to separate the cuttings from the compound.

The carriage is a broad slide extending practically the full length of the bed, and is scraped to a bearing its entire length. Double taper gibs are provided with fine thread adjustments at both ends. The cross slide is also very massive in construction, and in cast integral with the carriage.

The head and tailstock are located and carried by the rear shear. This permits the carriage to travel past them, thus keeping the slides continuously covered. It is this extreme long carriage bearing that is the big factor in producing rigid-

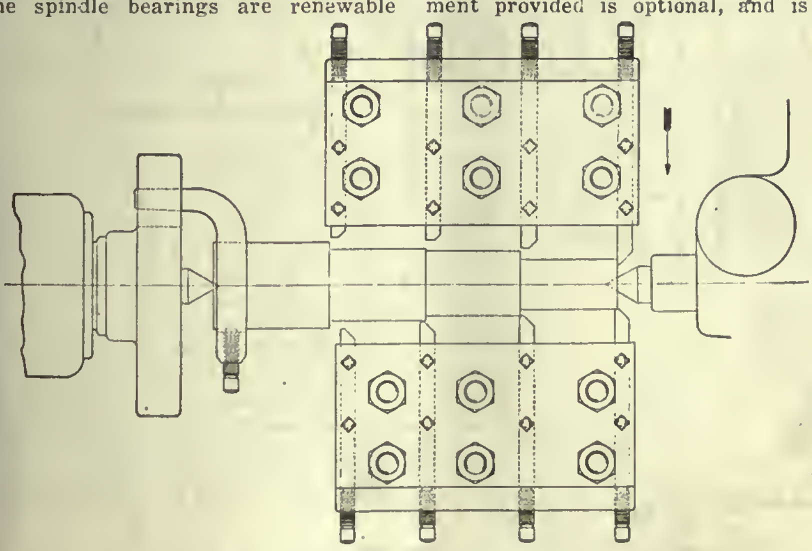


FIG. 8—FINISHING OPERATIONS ON A SLEEVE BEVEL GEAR.

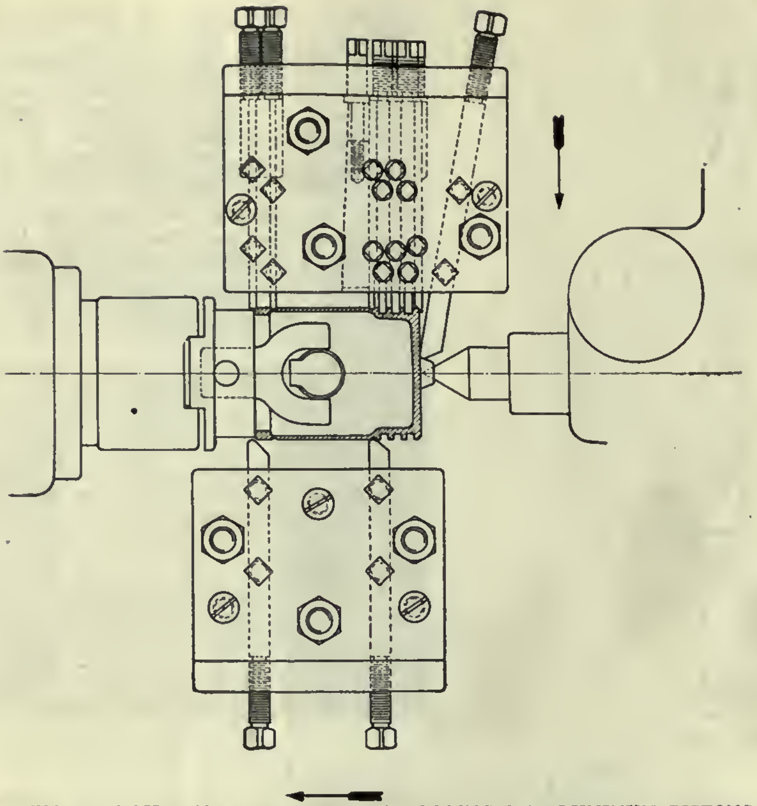


FIG. 10—ROUGHING AND FINISHING TOOLING ON ALUMINUM PISTONS.

ity, and permitting the use of gang tools, forming slides, etc.

The plain facing attachment is shown at Fig. 3. This attachment faces diameters up to the full swing of the lathe at right angles to the turning centres. The feed of the slide is obtained entirely by the relative movements of flat and dovetail slides accurately gibbed and adjustable to compensate for wear. There are on a broad, square lock slide, to which no cams either fixed or adjustable to consider. The rest is fed towards the centre employed is a No. 9, and equalizing face it is accurately gibbed. The cross facing slide is movable along the bed, and rigidly clamped to the shears in any desired position.

The facing bar slide carries the swivel guide bar which is fed along the bed at varying rates of speed. A sliding shoe on the facing attachment slide engages the swivel guide bar, which may be set at any angle within the range, imparting a vertical motion to the shoe which is transmitted through a rack and hardened pinin to the cross slide. By changing the angularity of the swivel guide bar the feed of the cross slide is varied or timed to complete its work at the same time as the turning slide to permit of overlapping on forming and turning tools or vice versa. The feed to both turning and facing slide are tripped by the same clutch and will duplicate within close limits of accuracy. The standard tool block is arranged for multiple tools which can be held parallel or at any angle by reason of the spacing of the binder screws. The tool block is adjustable to the centre of the lathe and firmly clamped in position by two heavy bolts.

The universal facing attachment is adapted to angular facing operations on bevel gears, etc. When used in connection with a taper turning attachment, the back and face angles can be turned and faced simultaneously. A swivel block is accurately graduated to facilitate angular settings and clamped firmly in the selected position by two heavy T slot bolts in a circular T slot. The feed is through a pair of hardened, generated, mitre gears to the feed rack. Aside from the swivel feature, the universal attachment and tool blocks are identical with the plain attachment as already described.

Feed for Turning and Facing Slides

The variations in feed for turning and facing slides are obtained by loose change gears applied to the feed bracket and worm box. The feeds read in "thousandths per revolution of spindle," and a simple, direct reading is provided with each machine to show the change gear combinations and the resulting feeds.

The feeds of the front slide are fixed by the change gears used, while the feeds of the facing slide may be further varied with relation to the feed of the turning slide by the angularity given the swivel guide bar; resulting in a practically unlimited combination of feed relations. When on forming or heavy reductions with the facing slide it is sometimes desirable to accelerate or retard the feed as it approaches the centre; this is done by replacing the swivel guide bar with a former bar and roller designed to suit a specific job. The feeds are tripped to a line by a sensitive acting, positive jaw clutch, heat treated and hardened, engag-

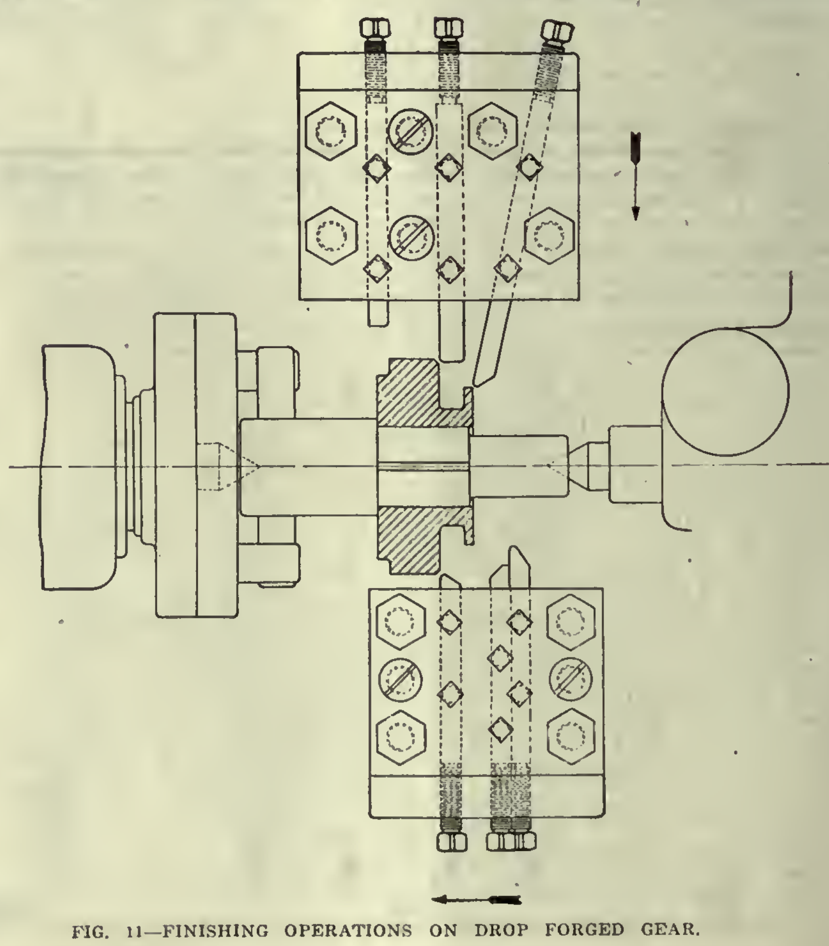


FIG. 11—FINISHING OPERATIONS ON DROP FORGED GEAR.

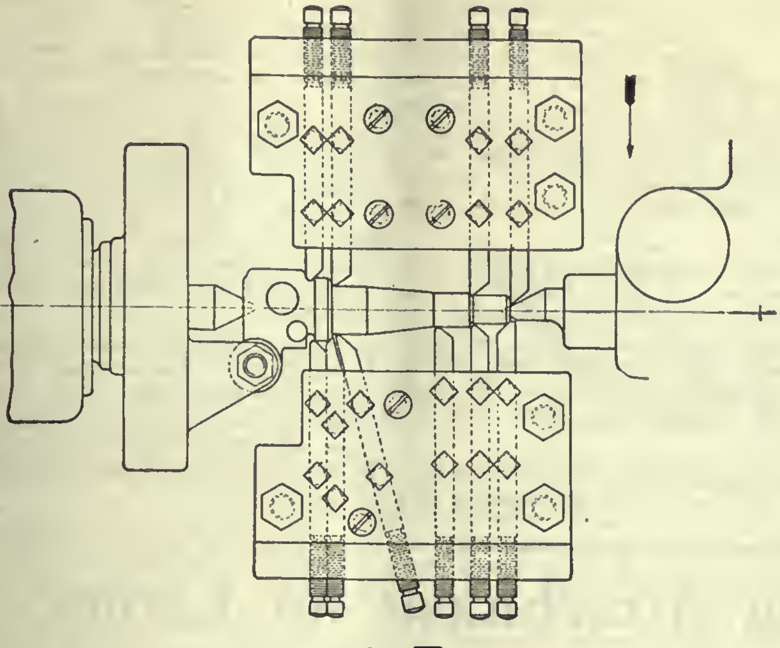


FIG. 12—TURNING OF A DROP FORGED STEERING KNUCKLE.

ing a similar clutch mounted on the worm wheel.

The feed drive is then through changeable gears and a pinion and bullwheel to the rack on the carriage. The drive to the facing slide is through similar change gears, through the bed, to the feed rack on the facing attachment slide on which the swivel guide bar is mounted.

The feed rack for both carriage and facing attachment is placed in the centre of the slides, imparting a smooth, unrestricted feed without the usual binding action occasioned by applying the power away from the centre of the guiding shears and the resultant of the greatest working strain. A hand wheel at the front of the worm box furnishes means of quickly returning the turning and facing slides to the starting position after the completion of each cut. The worm wheel and clutch are running continuously in oil and the thrust of the worm is taken against ball thrust bearings. All of the gears subject to the greatest strains are of nickel steel, heat treated and hardened.

Having given a very fair idea of the various features connected with the machine, we will next consider some examples of work accomplished.

Interesting Examples

At Fig. 4 is shown a typical tool set-up. In this case the machine is equipped with a special compensating face plate driver, special multiple tool block on front and rear slides, and a former bar on the facing attachment in place of the regular guide bar, which furnishes means of slowing up the feed of the facing tools for forming the heavy fillets.

The work being performed is that of machining an automobile wheel hub. These hubs are made of alloy steel forgings. The hub has been previously bored, taper reamed, and the flange end faced and recessed on a turret lathe. The operation on the Multi-Cut lathe is the finishing to size in one operation with nine cutting tools. All tools used are ordinary lathe tools, mounted in quick removable tool blocks and ground to gauges. The operator handles two mandrels, and loads one while the machine is in operation. The turning time on these hubs is 1.6 minutes each.

The feed trips automatically to a line and duplicates to close limits of accuracy. The tailstock spindle is brought up to the arbor and clamped with a single lever movement and the work is flooded with cutting compound from a geared pump, then returned to the base of the machine through the strainers already mentioned. At Fig. 5 is illustrated the tool layout of the work. It will be noted that four of the nine tools are turning tools and the other five facing tools which cut simultaneously.

Another good example is shown at Fig. 6. This is the turning, facing and flanging of an automobile wheel hub in one operation. Two turning tools and five facing tools are at work. Special tool blocks, two mandrels, equalizing face plate driver and plain facing attachment form the equipment. One operator can readily run two machines, which of course means a larges production at lower cost.

The next example is that shown at Fig 7. In this case a cast steel bevel gear is being completed. The work has been previously bored, reamed and scaled off on a turret lathe. The back angle, face angle, fillets and undercuts are being finished in this illustration. The machine plate driver, special multiple tool blocks, universal facing attachment, taper attachment and two mandrels form the remainder of the equipment.

At Fig. 8 is depicted the finishing operations on a sleeve bevel gear which has been previously roughed out on an automatic bar machine. The work being performed in the illustration is that of finishing diameter, also back and face angles, one facing tool, two forming tools and two turning tools are cutting at the same time. An equalizing face plate driver, plain facing attachment, special tool blocks and two mandrels are used.

Next comes Fig. 9, a good example of multiple tooling on a transmission shaft.

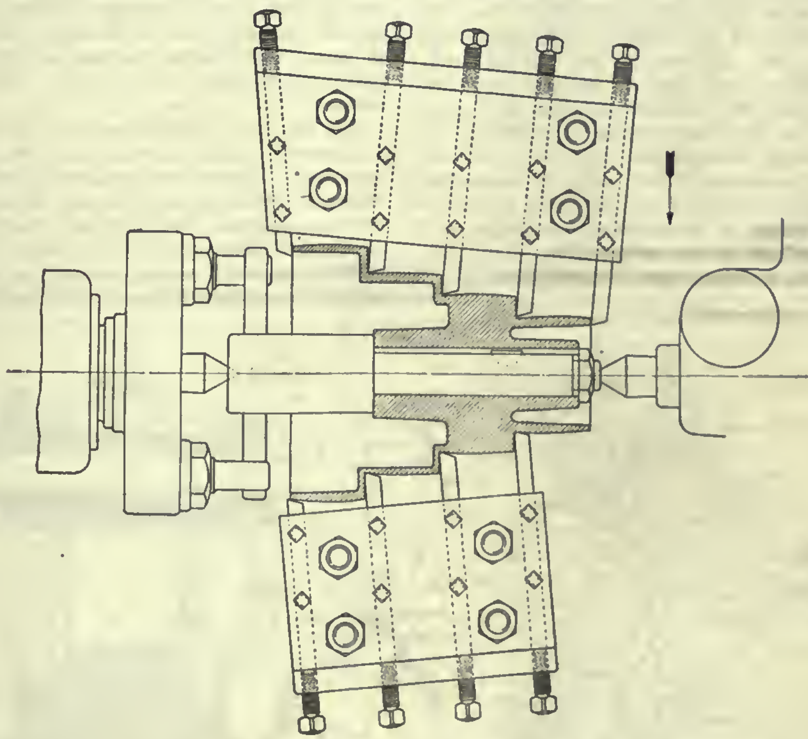


FIG. 13—FINISHING OPERATIONS ON A CROWN FACE PULLEY.

This is a simple turning and facing proposition, four turning and four facing tools being used, each completing their respective operations at the same time. This illustration is a splendid example of the wide variety of work possible in a lathe of this nature.

At Fig. 10 is illustrated an operation on aluminum pistons. Two machines are employed, one equipped with roughing and one with finishing tools. The tools are set and ground to gauge in the blocks, a reserve set being kept on hand ready for use. The pistons are roughed all over and ring grove stocked out at first operation. The finishing operation is of similar nature, only the finishing cut. A special driving chuck, special tool blocks and tools and plain facing attachment are used.

A drop forged transmission gear made from nickel alloy steel is shown at Fig. 11. The hole has been bored, broached square, and one side faced in previous operation. The work is now completed in one handling. It is held on a square centred arbor, three turning, and three facing and forming tools being used. These are held in special blocks. A plain facing attachment is used in this example.

The next example shown at Fig. 12 is the turning of a drop forged steering knuckle. This work is completed on centres, a special drive plate, six turning and chamfering tools, four facing and necking tools being used. The tools are held in special tool blocks for the purpose.

Our last illustration is shown at Fig. 13. This view depicts the finishing of a crown face core pulley. In previous op- erations the pulley has been bored reamed, hub faced and keywayed. Th material is cast iron.

A former bar is substituted for th taper attachment guide bar on the fron slide for producing the crown on th pulley. Four turning tools and five fac ing tools are used. The other equipmen consists of plain facing attachment equalizing face plate driver, two arbor and special tool blocks and forming at tachment.

These examples of work performed wil no doubt be of double value. First the will show clearly some of the work com pleted on this style machine and secon they will demonstrate to the practica worker in the shops new possibilities i tool layout.

Novel Relieving Attachment for Lathes*

ALTHOUGH it is usually considered to be uneconomical to make milling cutters and other small tools in a general engineering shop, occasions sometimes arise when it would be extremely convenient to be able to do so. It may easily happen, especially in small shops, that a job may be delayed for days in waiting for a certain tool that could be made in an hour or two if the necessary appliances were available. The lathes, milling machines with dividing heads, gas muffles, etc., needed for the work, form part of the equipment of practically every shop, but main difficulty occurs in connection with the work of backing off, or relieving, the teeth of the cutters. The teeth can, of course, be formed by milling with special cutters, but the number of these required for different shapes and sizes of tools is, in most cases, prohibitive. A relieving lathe, which might be employed, is an expensive tool of very little general utility, so that it is not often found in small shops. It would certainly not pay to instal one for an occasional odd job, but this objection cannot be applied to a comparatively inexpensive attachment which enables relieving work to be carried out on an ordinary screw-cutting lathe.

Such an attachment, which is the invention of Mr. E. M. Wildey, and is being manufactured by Messrs. Milton, Limited, of Besley Street, Streatham, London, S. W. 16, and is illustrated by the drawings, Figs. 1 to 5. On account of the high speed at which the machine will operate, the makers consider that it will be found economical to use it for the manufacture of plain cutters, reamers and similar tools instead of milling them, since the only gashing necessary can be done by a narrow slotting cutter, or even by a metal slitting saw; the expense of a large number of special cutters and end mills would thus be avoided.

The drawings reproduced in Figs. 1 to 5 illustrate the construction of the attachment. Reference to these drawings will show that the attachment is mounted on a gibbed plate, which is screwed on to the lathe saddle. Into this plate is fitted a steel casting having a large hole through which passes the work, or the arbor on which the work is mountec between the centres of the lathe. Ther are two oscillating tool posts carryin tools which can operate simultaneousl on the front and back of the work though, for relieving, the front tool only is employed. The tool posts are formed by fork-shaped steel castings each of which is mounted on a separat shaft passing through the lower par of the main casting. These shafts hav eccentrics formed at each end, and b turning these eccentrics it is possibl to adjust the cutting tools in a vertica direction to allow for any alteration i height which may have been introducec by grinding. The transverse adjustment of the tools is effected by a knurled nut mounted on a stud fixed in th tool post, and working in a slot formec in the side of the tool. The tools themselves fit in slots in the tool posts, anc are each clamped in position by a bol and nut.

The tool posts are rocked by means o two eccentrics mounted on a centra shaft passing through the upper part o the main casting, and clearly shown i Fig. 2. These eccentrics, which are con-

*From "Engineering."

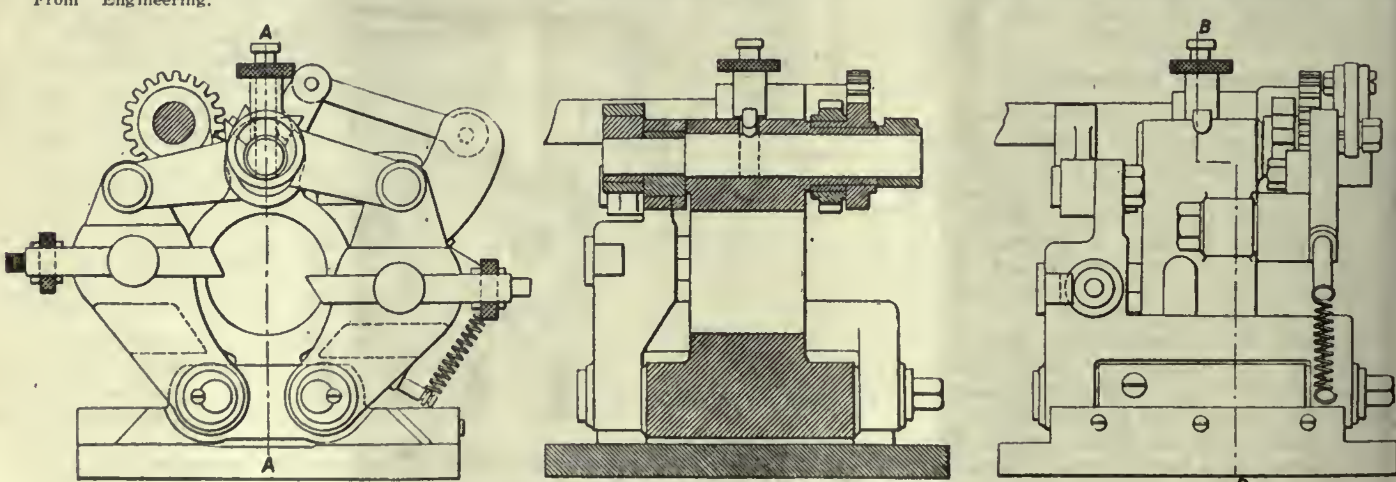


FIG. 1—LEFT HAND VIEW. FIG. 2—LONGITUDINAL SECTION. FIG. 3—FRONT VIEW.

nected to the tool posts by means of short links shown in Fig. 1 are set at an angle of 180 deg., so that angular motion of the shaft will cause both the tool posts to advance into, or recede from, the work together. Mounted loosely on the opposite end of the central shaft bearing is a gear wheel and on a sleeve extending from the boss of this wheel is screwed a ratchet-toothed cam, which can be distinguished in most of our illustrations. The cam is driven from the nose of the lathe by means of a shaft having two universal joints. The key of the gear wheel meshes with the one attached to the cam and fits into a long keyway. This arrangement allows the whole attachment to follow the side traverse of the saddle in screw cutting or other work. The cam rotates at the same speed, and in the same direction, as the work, and it may here be mentioned that the cam must have the same number of teeth as the tool being relieved. The actual diameter of the cam, and the shape of the teeth, are immaterial, but the teeth must be formed with feather edges. Certain special types of reamers and cutters in which the teeth are unequally spaced can be relieved by means of the attachment, but for this purpose the teeth of the cam must, of course, be spaced to correspond with those of the work.

Referring to Fig. 4, it will be noticed that the teeth of the cam engage with an adjustable pawl mounted on one arm of a bell-crank lever, which is pivoted on the main casting. As the cam rotates in an anti-clockwise direction the arm of the bell-crank lever will be pulled downwards until the pawl escapes from the tooth of the cam, when it will be pulled up into engagement with the next tooth by the action of a light helical spring. The combined effect of the cam and spring is thus to impart an oscillating motion to the bell-crank lever. On the other arm of the latter is formed a segmental groove, and in this groove a block, to which a short link is pivoted, can be clamped in any position. The other end of the link is connected to an arm keyed on to central shaft, above referred to, and in this way the oscillating motion of the bell-crank lever is communicated to the central shaft, and also, through the eccentrics, to the tool posts. Two short springs fitted between projections on the forked parts of the tool-posts and the main casting, and clearly shown in Fig. 4, are provided in order to take up any lost motion due to wear of the links, etc.

It will be obvious that the position of the block in the segmental groove determines the magnitude of the angular oscillations of the central shaft, and consequently those of the tool posts, so that, by adjusting the block, the amount of relief can be varied at will quite independently of the shape of the cam. The actual amount of relief is indicated by a scale engraved on the arm of the bell-crank lever, as shown in Fig. 4, the figures giving the amount of relief in millimetres. The motion will, of course, cease entirely if the block is brought

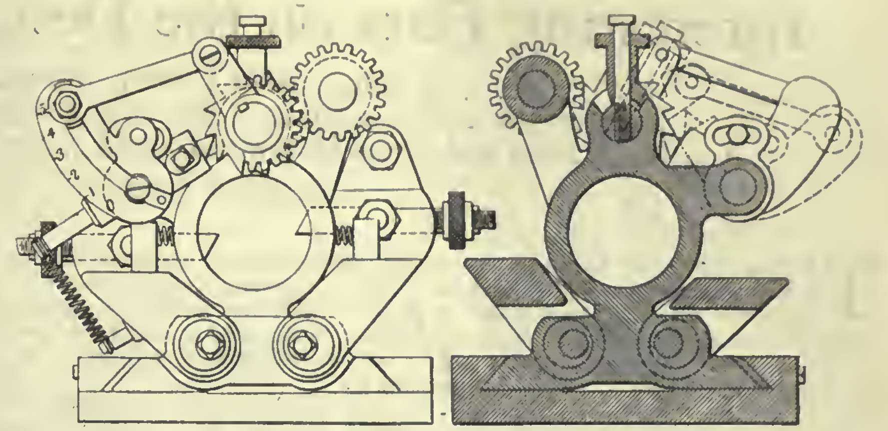


FIG. 4—RIGHT HAND VIEW. FIG. 5—CROSS SECTIONAL VIEW.

down to the centre of oscillation of the bell-crank lever, and this enables ordinary plain turning, or screw cutting, to be done without removing the attachment from the lathe. The only other feature of the mechanism now remaining to be explained is the means provided for limiting the backward movement of the tools in normal working, while allowing them to be brought back clear of the work before reversing the motion of the saddle to commence a new cut. This arrangement is best shown in the cross-section, Fig. 5, from which it will be seen that a bolt fitted with a sliding sleeve is screwed into the middle of the central shaft. A tongue formed on the sliding sleeve fits into a slot in the main casting, and normally limits the movement of the shaft by coming into contact with the end of the slot, but when it is desired to withdraw the tools from the work the tongue is pulled out of the slot by raising the sleeve. This allows the spring attached to the bell-crank lever to pull the latter back into the position indicated by the dotted lines in Fig. 5. In this position the tools will be quite clear of the work and the pawl clear of the cam; the lathe can then be reversed without altering the adjustment of the tools in the tool holders. This is a great advantage when relieving screwed hobs; and is also convenient for ordinary screwing without relief.

As previously mentioned, the front tool only is used for relieving, but for plain turning and screwing both tools are employed, and it is then convenient to be able to feed both tools into the work simultaneously and withdraw them together at the end of a cut; otherwise there could be no necessity for connecting the back tool to the oscillating mechanism. When operating both tools for plain turning or screwing the bell-crank lever is pinned in the position shown by the dotted lines in Fig. 5, and a simultaneous feed is given to the tools by moving the link down the slot in the lever arm. It is, of course, not necessary to disconnect the backpost when relieving; the tool need only be screwed back clear of the work.

An important advantage of the pivoting tool holder in comparison with the horizontal slide of the ordinary relieving lathe, is that, in the former, the tools can be adjusted so that the cutting angle remains constant at all parts of the cut, and consequently greater cutting efficiency is attained and a tool with much less clearance can be used. That it is necessary to tilt the tool for this purpose will be obvious when it is remembered that the normal to the relief curve at the cutting edge of the tooth being formed coincides with the radius of the plain cylindrical blank, since no metal is removed from this part of the tooth, whereas, at the inner end of the curve, the normal is inclined by an amount depending on amount of relief. In ordinary relieving lathe, in which tool moves horizontally, no allowance is made for this feature, and the cutting angle may therefore vary by 15 deg. or 20 deg. from one end of the relief curve to the other. Another advantage of the pivoted tool holder is that the friction is considerably less than that of a sliding holder, and consequently a greater proportion of the power supplied is available for the cut in the former system. It is also pointed out that the fact that the tool-holder is operated from a point well above the tool gives great rigidity in cutting.

The attachment illustrated can be applied to any screw-cutting lathe of 6 in. centres, or upwards, and is capable of dealing with work up to 2¼ in. in diameter for the whole travel of the saddle, while work up to 2½ in. in diameter and 1 in. inch wide can be relieved outside of the central hole in the main casting; larger sizes are, however, now being made. Messrs. Milton, it may be added, themselves use the attachment extensively in the manufacture of small tools.

At the request of the Swiss Standards Association, Baden, Switzerland, for co-operation in the work of standardization of ball bearings, the American Engineering Standards Committee requested the American Society of Mechanical Engineers and the Society of Automotive Engineers to act as Joint Sponsors for the project. These societies have accepted the responsibility and are now organizing a Sectional Committee for the work. The Sectional Committee will be thoroughly representative of all the interests involved and is the body which will be responsible for the detailed formulation of the standards.

Interesting Data on the Design of Flywheels

A Flywheel is a Complicated Part to Design, and Owing to Its Function, it is Dangerous to Guess at its Proper Proportion. The Data and Chart Herewith Should Remove All Doubt.

By JOHN S. WATTS

THE designing of fly wheels is a rather complicated affair, and is not given the attention it deserves in the text-books. A fly wheel designed by rule of thumb, as most of them are, may very easily prove a dangerous article.

Fortunately for the rule of thumb designer, it is impossible to make the fly wheel too heavy, as the heavier it is the more effectively it will perform its function of keeping the periodical fluctuations of speed down. While a heavy fly wheel gives a steadier speed, it is, however, wasteful to use one heavier than is really necessary, as it imposes an unnecessary loss on the power of the engine or motor by reason of the additional friction of the bearings.

The arms of the fly wheel, if not properly designed, may be dangerously weak, as it is essential that these arms be sufficiently strong to transmit the strain, due to the fly wheel alternately taking energy from the shaft, and returning energy to the shaft. The arms are really the weak point in many designs, and the method of calculating the dimensions of the arms by an empirical formulae in proportion to the section of the rim is misleading. The strain upon the arm is more dependent upon the percentage of speed variation which occurs, and upon the length of time during which the fly wheel is giving up energy, than it does upon the weight of the rim.

There are, broadly speaking, two main uses for fly wheels, first, on steam engines, to bring the periodic fluctuations of speed during each revolution due to the varying leverage of the connecting rod, and to the variations in steam pressure in the piston during the stroke, down to a pre-determined percentage necessary for the efficient use of the machinery to be driven by the engine.

Secondly, fly wheels are used on machines that are performing work during only a part of the time, such as punching and shearing machines, etc. The function of the fly wheel in these cases is to store up energy from the motor during the period that the machine is running idle and deliver up this energy while the machine is under load, thus enabling us to use a much less powerful motor than would otherwise be necessary.

Taking up the design of a fly wheel for a steam engine first, the requirements are to know the variation between the maximum and minimum turning efforts on the crank pin. It is obvious that the minimum turning effort is zero, and occurs at each dead centre. The maximum turning effort is when the crank is at an angle of ninety degrees with the connecting rod as shown in Fig. 1. That is assuming that the steam is not cut off until the crank has passed this point, which, as the piston is then at about four-tenths of its stroke, is unlikely.

Calling the effective pressure on the piston P, and the resultant pressure along the connecting C, we have

P = C, cos a

and, as the angle

C A B = the angle A D C

∴ A B = A C × cos a

The turning effort being

C × AB = C × A C × cos a
= P × A C.

We must now decide as to what fluctuation of speed we can allow during one revolution, which depends entirely upon the purpose for which the power of the engine is to be used. The following table may be taken as fairly average practice for the purpose specified therein, the fluctuation being expressed as a percentage of the mean speed.

Hammering and crushing machinery	20%
Pumping and plate shears or punches	5%
Portable saw mills	4%
Machine shop tools	2.8%
Textile and paper making machinery	2.5%
Flour mills and spinning machines	2%
Electric generators	2-3%

The mean turning effort can be arrived at by calculation from the indicated horse power of the engine, as follows:

Mean turning effort in inch pounds =

$$\frac{H P \times 33{,}000 \times 12 \times \frac{S}{2}}{\pi \times S \times R.P.M.} = \frac{H P \times 198{,}000}{\pi \times R.P.M.}$$

Where S = stroke in feet and R.P.M. = revolutions per minute.

The problem can be stated as: to find the dimensions of a fly wheel that will have the weight and velocity required to absorb the energy due to the difference between the maximum and the mean turning effort, and to give up this energy when the turning effort is less than the mean turning effort with a total variation of speed between minimum and maximum, not exceeding that percentage of the mean speed given in the above table.

If we make up a diagram of turning moments, showing graphically the variation by finding the turning moment due to the effective pressure on the piston multiplied by its lever arm, as at A C in Fig. 1, for say each ten degrees of movement of the crank, we get a curve similar to that shown in Fig. 2.

When possible the effective pressure on the piston, as used in making up this diagram, should be taken from an indicator diagram from the same or similar engine. If that is not available, a theoretical diagram can be calculated and drawn. Note carefully that the base line

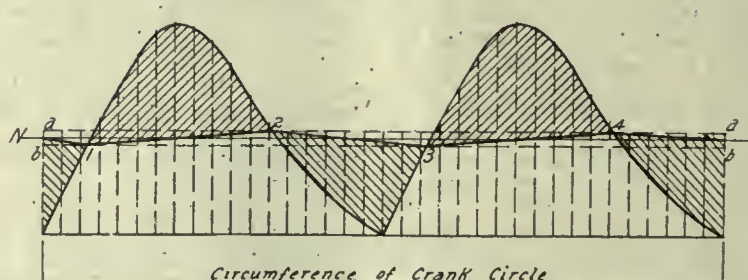


DIAGRAM OF TURNING MOMENTS SHOWN GRAPHICALLY.

of the diagram is equal in length to the circumference of a circle whose diameter is the stroke of the engine, and represents the travel of the crank pin not the piston. The vertical lines represent the turning moment in inch pounds at each ten degrees movement of the crank pin.

The line N N represents the turning moment, and the dotted lines, a a and b b, represent the allowable variation in speed, which will be proportional to the variation in turning moment allowable. That is, the distance between the lines a a and b b is the same percentage of the height to the line N N as the percentage of speed variation allowed.

Now, if the fly wheel absorbs the energy due to the turning moments above the line 1, 2, shown shaded, and gives out this energy to increase the turning moments of the engine, when it falls below the line 2, 3; also shown shaded in the diagram, the resulting combined turning moment of engine and fly wheel will always be between the two lines a a and b b. And it follows that if the turning moment is kept within the prescribed limit of variation so will the speed.

The area of the shaded portions in Fig. 2 represents the energy which is to be absorbed and given out by the fly wheels, and as of necessity, the energy given out must be exactly equal to that absorbed, these two areas must be equal. The dotted lines a a and b b must, therefore, be raised or lowered, keeping the distance between them the same as before until the shaded areas above and below are equal to each other

As the peripheral velocity of the crank pin will be directly proportional to the turning effort at any point of its revolution, we may take the line N N as representing the mean velocity, and a little study will show that the actual velocity of the crank pin, and also of the fly wheel, will vary about as indicated by the line 1, 2, 3, 4, and that the fly wheel must store up the energy represented by the shaded portion above the line 1, 2; while increasing its speed from the minimum at point 1 to the maximum at point 2.

To find the value of this area in foot pounds of energy, the vertical heights being moments in inch pounds, and the horizontal lengths being distances travelled through, the mean height of the area will be the mean effort in inch pounds, which, divided by the radius of the crank pin circle in inches, will give us the mean pressure in pounds on the crank pin, and multiplying this by the horizontal distance between the points 1 and 2, in feet, which is the distance through which this mean pressure acts, the product will be the energy in foot pounds to be stored up in the fly wheel.

The energy to be given out by the fly wheel having, as already shown, been made equal to that absorbed, we need not concern ourselves any further about it.

Now, having determined the energy to be absorbed, and knowing the increase of speed which can be allowed in the fly wheel while taking in this energy, we can evolve a formulae which will give us the required weight at any chosen velocity of rim, which, of course, depends upon the speed of the engine and the diameter of pulley which can be used.

The kinetic energy of a fly wheel in foot pounds is

$$\frac{V^2 \times W}{2 \times g}$$

Where

V = Velocity in feet per second of the centre of gyration of the rim

W = Weight of rim, in pounds

g = Acceleration due to gravity = 32.2

And, in the following formulae:

E = Energy in the fly wheel at the maximum velocity

e = Energy in the fly wheel at its minimum velocity, both in foot pounds

V = Maximum velocity in feet per second

v = Minimum velocity in feet per second

The excess energy, to be absorbed, has already been decided and will be $= E - e$, and calling this quantity x, we have

$$E - e = x = \frac{V^2 \times W}{2 \times} - \frac{v^2 \times W}{2 \times g}$$

$$\therefore x = (V^2 - v^2)\frac{W}{2 \times g}$$

$$\therefore W = \frac{x \times 2 \times g}{V^2 - v^2}$$

It will be noted that the weight required decreases as the square of the velocity and that it is therefore more economical to make the diameter, and hence the velocity of the wheel, as large as circumstances will permit, up to the limit of velocity of one hundred feet per second, which should not be exceeded as above that speed the stress due to centrifugal force becomes too high for safety, that is for cast iron wheels.

The turning effort for cross compound and triple cylinder engines is much less variable, and can be shown by a design similar to figure 2, and is determined in the same manner, as for the single cylinder engine by adding on the proper lines the turning moments for the other cylinders to that of the first cylinder, thus getting a curve exhibiting the varying moments of each crank position for the combined moments of all the cylinders.

For the fly wheels of punching machines and the like, the power supplied by the belt or motors is taken as being uniform, and the energy to be absorbed can be arived at by calculating the power in foot pounds, supplied to the machine during one cycle. From this should be deducted the percentage necessary to overcome the friction of the machine.

Then calculate the foot pounds of energy required to punch the hole and deduct from it the amount of energy put into the machine (over that required to overcome the friction), during the period of time in which the hole is being punched and the balance left will be the energy which is to be stored up in the fly wheel, and later given out by it with a variation of speed which should be low enough not to injure the belt or driving mechanism.

In the absence of more precise information, this variation between the high and low velocity may be taken as six per cent. of the mean speed.

The formulae given above will then give the required weight of the fly wheel, it being understood that this weight is in all cases the weight of the rim alone, as, although the arms and hub have some effect, it is so small as to be negligible.

The next point to decide is the section of the arms, which is a most important one, and the common method of calculating the arm by rule of thumb, frequently results in cracked arms after a short period of service. The cause of cracked arms is frequently blamed on internal stresses due to unequal cooling after casting, but in my experience is most often due to the arms being too weak to transmit the often severe and alternating stresses imposed upon them in transmitting the turning effort to and from the rim to the shaft.

The possibility of a machine being overloaded, or even stalled, should be also seriously considered in designing the flywheel arms as the stress in the arms of a fly wheel suddenly brought to rest may be infinite, and there is nothing more dangerous than a fly wheel when it breaks loose. The arms should be at least strong enough to break some other part of the mechanism, thus allowing the fly wheel to dissipate its energy by running idle after breaking the weaker part.

This strain on the arm can be determined from the curve of turning moments in figure 2; and while it may be possible to get a satisfactory weight of rim without drawing this curve by using empirical formulae, based on average conditions; this curve should be drawn out both for engines and machines to determine the maximum strains on the arms.

The maximum strain on the arm is found by scaling the length of the extreme turning effort above or below, whichever is the greatest, the mean line N N and the turning moment being in inch pounds, will be divided by the radius of the pulley in inches give the pull an the arms. Or, more simply, this maximum turning moment is the maximum bending moment on the arms.

If the fly wheel is also used as a belt pulley, the pull of the belt must be added to that due to the interior of the fly wheel. It may be assumed that the strain due to the inertia, or turning moment, is taken equally by all the arms, loaded as cantilevers, with the load concentrated at the end, and the stress used should not exceed 1,400 pounds per square inch for cast iron, and 3,500 pounds per square inch for steel castings, on account of the stress being rapidly reversed.

(Continued on page 65)

WHAT OUR READERS THINK AND DO

Is the Drawing Course Dead—or Only Asleep?

The Writer of This Letter Requests Us Not to Use His Name, but We Cannot Help but State that He Holds a Very Responsible Position, and Knows Whereof He Speaks.

ANSWERING to your query on page 225 of the February 25th issue of CANADIAN MACHINERY, I would like to say to you that the trouble is not with the drafting course, it is with those who are following it up. It is but natural that at the start of anything of this nature, many should say to themselves "that is just what I want, I will make up these plates and send them in. As time passes and the work becomes more advanced, all those who do not have a real interest in it will drop out from time to time.

This will hold good for almost any trade or profession, or even for school. Compare the number of pupils entering the first grade each year to those who graduate from the high schools. Compare the number of Freshmen at a University with the Senior Class. There can be nothing obtained in the way of an education of any kind withcut good, patient, hard work. There is no pleasure or happiness in getting results without it.

There is nothing seriously wrong with the course as laid out. I would have but one suggestion to offer and that is that all elementary work, including projections, be covered before taking up the object drawings. The great trouble with the young men of to-day is, that they want to make lots of money and put up a big front. They are not content to work as apprentices and put in their spare time in study, thereby fitting themselves for higher positions. It is an actual fact that the better the position you have to fill, the harder it is to get a man to fill it.

If the young men of 16 to 21 could only have this brought home to them in such a way that they would realize that these are the best years of their life for laying the foundation of their life's work, we would have a better class of men for these higher positions. It seems that most of these boys want to have a good time, as their sole excuse for working. This is a poor foundation on which to build up a profession. As I look at it, for a man with a leaning towards mechanical lines, there is nothing more interesting than the designing of machines to meet new problems, and there is always lots of room at the top in this work.

I was not at all surprised when your question was put. Your course had just reached the stage that the one working on it had to start and put in some real time and study on the plates. If he had no real interest and patience, he would drop out. I would like to see this course carried out for the benefit of those remaining, provided there are enough to warrant it. This is a duty you owe to those who are really interested and want to benefit by your course.

As one responsible for the design of machinery in one of our large plants, the writer has found from experience that the man who supplements his work by study, is the man who is ready to take a bigger job when the job comes along.

Editor's Note.—We appreciate this letter very much, especially as it comes from a man who is in charge of a large designing department in a modern manufacturing plant. We agree with him in every particular, and to be candid, we were very disappointed to find that readers lost interest in the course as soon as it really meant some careful study.

Suppose we make a fresh start, and, if readers so desire, under new conditions, namely, that it is not necessary to send your plates into this office. Those wishing to do so have that privilege, but the others not caring to submit their work, can study quietly at home.

We particularly wish to hear readers' opinion on this matter. For example: Suppose we ask the following questions: "Do you want the drawing course to continue? Do you want to study at home, or will you send in your plates?"

Providing we receive a reasonable number of letters favorable to the continuance of this course, we will commence it once more, from the point where we left off. It was our intention to take students right through the design of a well-known and popular milling machine, but evidently the benefit of such an opportunity was not properly realized. Let us hear from you.

Does It Really Pay to Study?

By D. A. H.

AN eminent college professor has said that it is "marvellous the power of the mind to resist knowledge." Going this one better, I might say that "it is marvellously sad to think of so many human minds that want to resist knowledge." Only a few short years ago, boys would give their eye teeth to get an apprenticeship in a machine shop, to be one of the envied few who worked among the dirt of levers and wheels and engines; and once the coveted position was obtained (at two dollars a week)—the desire camme to burn the midnight oil, studying some of the none too plentiful books of the time, dealing with theoretical mechanics and drawing.

The age of the correspondence school and the trade put the tools of learning within the reach of the humblest apprentice. As the need for more men in industries grew, there came more opportunities for those with special knowledge and more money for all. Also there appeared numerous ways of spending time and money—ways far more pleasant than pounding over dry facts and figures—and there also came opportunities for earning big money on piece work without serving any long apprenticeship.

Ed. Byer and myself had been school mates together. We went to work in adjoining buildings—he in a wood-working establishment and I in a machine shop. Both of us took out correspondence courses, and for awhile we compared notes, but in two or three years the old intimacy waned and we saw little of each other, partly because his place had become unionized and worked shorter hours than ours. Once I remember I saw Ed. and I asked him how he was getting on with his course. "Dropped it long ago,—it's only a fiasco anyway," was the answer. About a year later, as I was coming home in working clothes, I met him fully dressed for some social affair. "Aw, Don, why don't you join the union?" was the greeting as we passed.

I must admit that I was a little envious to think how he had all that extra time—by the time I was through, he had eaten and dressed and started for an evening's enjoyment. All this while I was plugging away at the old correspondence course, often falling asleep at the table and at an hour when my ex-pal was just having the biggest of times.

Now, Ed. had plenty of ability—he was naturally gifted with a pencil—he wrote a beautiful hand and was an excellent amateur draftsman. He originally intended to learn the wood-working business and study architecture at the same time, but the union seed got planted and he soaked in a full charge of that stuff about doing only so much for day's work and the bosses were out to beat the men from their rights, and so on and so forth, and with this he dropped the studying.

There came a time however when business slackened up and Ed. was laid off. Unable to get work at wood turning, his favorite branch, he grabbed a temporary job in another shop running a variety machine. The first day at this unaccustomed work cost him two fingers. This was a hard blow. He moved to a river town as soon as the wound healed and finally landed a job, moving his family shortly afterward.

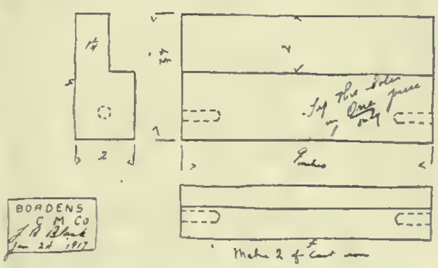
That was the last I saw of Ed. Byer until 1914. I knew that he was working at his trade like so many other good union men, depending on his union and his minimum efforts to keep him in just such a job for life, and his evenings were spent at the pictures or at the park. Ship building had been started in a small way in the river town; the war expanded this into a mighty business and a year later Ed. became one of the gang that punched the time clock at gate.

Draftsmen were needed at the shipyard—needed badly! Little wonder that this put an idea into Ed.'s brain—did more than that, as days rolled by and he saw these men who were trained step into the positions of importance and authority and salaries, not wages. Many were the regrets for the wasted hours of his youth, those hours when learning is easy and fixes itself so firmly in the mind. But our Ed. was made of the right stuff. He didn't let it go in regrets; he took out another correspondence course and started in middle life where he left off as a youth. Union hours then meant hours of deliverance, and a few months of studying to midnight brought its reward in a first promotion.. Thus leaving the rank and file, he advanced as rapidly as the advertisements tell and to-day holds a fine position in the concern which is established on a peace basis.

Another Case

I had heard of Ladue. He was supervising master mechanic for a well-known company. His work brought him to our city for some months, during which we did a number of jobs for him to avoid his having to send them to the home shop. Ladue was smart—there was no question about that—and he knew all about the business. But drawing is the language of the machine trades and Ladue didn't know how to draw. How a man ever got by in his position and how he ever reached it anyway with his ignorance has since been a mystery to me. The more so because he was constantly using drawings and prints made by first-class men—and the contact with these alone should have showed him his faults (rather deficiencies) and spurred him to train himself properly.

The accompanying sketch is a free-hand copy of a blue print made by Mr. Ladue himself. I select this one out of many because it is simple enough for any of CANADIAN MACHINERY'S beginners and yet it contains—or perhaps I should say "boasts"—no less than seven glaring errors which a two months' student would be ashamed to make. Note—no dash lines for the dimensions, arrows misplaced and turned wrong, a drilled hole shown dotted in the left elevation, the "f" for machine finish not even touching the line, the front elevation shows a full line for an invisible surface, the drilled holes which are invisible and should be dotted are drawn full, "inches" following 9 is entirely wrong, the material note is lettered in both capitals and small, a note in script should never appear on a B.P.



AN EXACT DUPLICATE OF THE STYLE SKETCH AS DESCRIBED.

It is not my intention to make fun of mistakes, but this galaxy beat anything I ever saw—and that from a man supposed to be first class—and who didn't even realize his shortcomings. The moral is—Keep up your studies, for everthing you ever learn about your business will come back to repay you many times over in future years.

OIL GROOVE ATTACHMENT

By G. Barrett

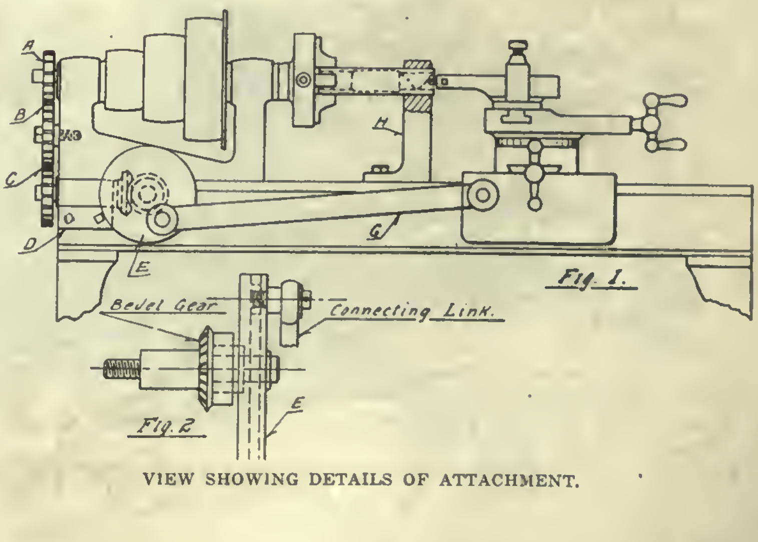
Here is how we cut some oil grooves on one of our lathes. The attachment as shown at Fig. 1 was rigged up on the lathe as shown, while the work we performed on the attachment was the cutting of grooves in drill spindle sleeves and crown gear hubs.

Referring to the front view, Fig. 1, we see that the gear A is keyed to the lathe spindle and drives the gear C through intermediate gear B. The gear C is keyed to a small shaft which is located in the fixed bracket D. At the other end of this shaft is fastened a bevel gear. This bevel meshes with another gear of similar make, which in turn is fastened to the disc E.

This latter disc is held to lathe by the stud F (shown in Fig. 2). The method of fastening the connecting rod to disc is also shown in this view.

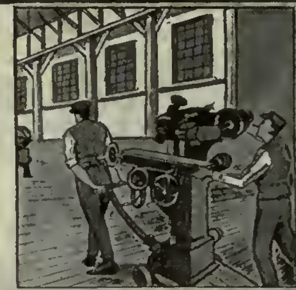
The link G is used to adjust the length of travel of lathe carriage. The special overhang noted at Fig. 1, was used on account of the sleeves being too large to enter the spindle of the lathe. The steady rest H, however, overcame this trouble.

Miners' Board Holds Meeting.—An informal meeting of the Conciliation Board composed of representatives of the Dominion Coal Company and the United Mine Workers, District No. 26, was held at Halifax. Several recommendations were made to the board, but nothing definite could be done, the authority for the board to act not having been received from Ottawa.



VIEW SHOWING DETAILS OF ATTACHMENT.

DEVELOPMENTS IN SHOP EQUIPMENT



BAR AND COMBINATION TURRET LATHES

The Albert Herbert Ltd., Coventry, England, whose Toronto office is located at 31 Yonge St., have placed on the Canadian market their well-known lines of bar turret and combination turret lathes. We will take these up in sequence.

At Fig. 1 is shown the bar type machine. This type of lathe is primarily designed for work from the bar, but is also extensively employed for certain forged work—while the combination turret lathe, shown at Fig. 2, is firstly a chucking machine, although, like all machines of its type, by the use of suitable equipment can be used very successfully for either bar or chuck work.

The hexagon turret lathes embody many interesting features, among which may be noted—the roller steady turning tools which are fitted with graduated micrometer adjustment to the tool. The rollers are supported on both sides and can be used for a cut equal in depth to the radius of the roller, thus permitting of the use of very small rollers in relation to the size of the work. The small rollers have, of course, the additional advantage of conveniently dealing with small diameters. Only one cut is required for each diameter, the finish obtained by the side cutting tool in conjunction with the rigidly supported rollers being exceptionally high.

The hexagon turret carries eight tools as standard equipment, viz., three roller steady turning tools as mentioned above, diehead, cutting-off and forming rest; and triple tooth-holder carrying roller steady ending and centering tools and length stop which can be swung clear of the turret face and enables bars to pass through it without interference with the adjustment. The turret is of very liberal proportions, being large in diameter and with very thick walls. It is fitted with power rotation and traverse.

The neat lines of design in the geared headstock and the convenient position of all operating levers can be noted. All speeds are obtainable in either direction. The feeds are direct reading in cuts per inch and are obtained by rotating hand wheel operating sliding spring key. The scale and pointer fitted on bed and the accurate length indicator on turret pilot wheel are worth-while refinements. The chuck design entirely eliminates spring collets, the makers claiming that the solid pad pieces used have many advantages. The design of the double toggle action chuck is very rigid and powerful.

Combination Type

In the combination lathes the same attention to clean-cut lines of design, strength, rigidity and detail is shown as in the hexagon lathe. The general features of the headstocks and turrets are the same in both types of lathes—it is to be noted, however, that the headstock spindle on the combination machines are made from a solid one-piece forging with flange solid with the spindle. This method, and the fitting of the chuck direct to the spindle, makes for rigidity and reduces the chuck overhang to a minimum. A wide range of feeds is provided through the gear box—changes of feed being made by the rotation of the hand wheel shown, which registers feed in cuts per minute. The feed shaft is fitted with a safety slip clutch. The lead screws are driven by a separate shaft which is driven directly through the gear box, and each leader is used to cut threads that are multiples of its own pitch in the ratio of 1, 2, and 4.

One distinct feature of interest is that when the nut is disengaged from the leadscrew the tool or chaser being used is automatically withdrawn from the thread being cut, without changing its relation to the cross-feed screw—or vice versa. All stops are designed to be used as automatic and dead stops. It will be noted that the longitudinal stop bar is in front and below the turret instead of within the bed, and rotates in relation to the turret. Stops may be placed in any position on its length and as many stops as may be desired in relation to any face of turret can be used. The usefulness of this on such work as repetition forming is apparent. A refinement in design in the longitudinal stops by what the makers term their unison stop adjustment is to be noted. In effect this is a means provided for adjusting the stop bar in either direction lengthwise, thus enabling such work

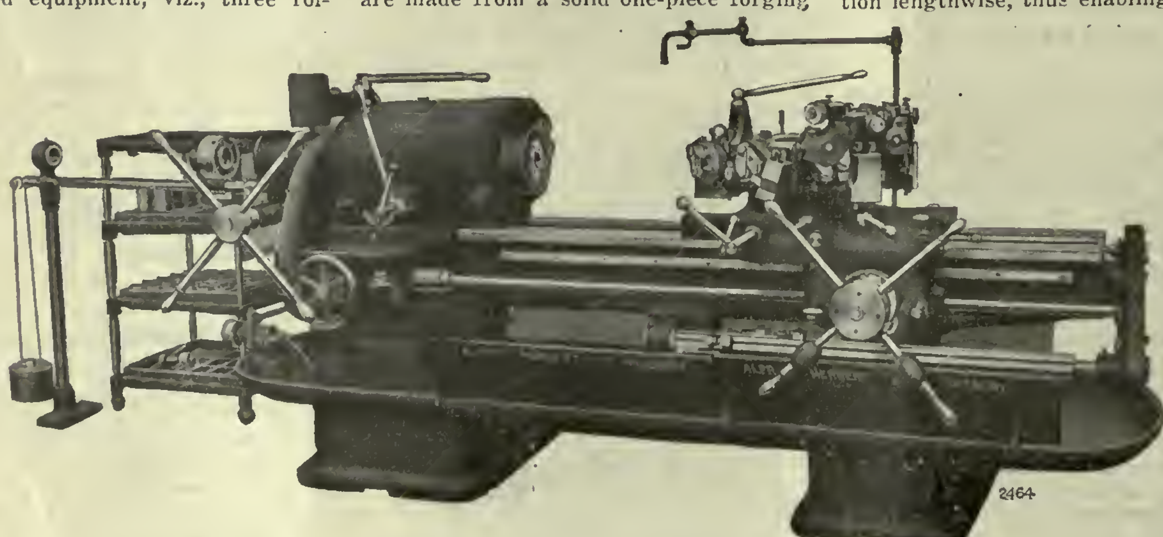


FIG. 1—GENERAL VIEW OF THE BAR TYPE MACHINE.

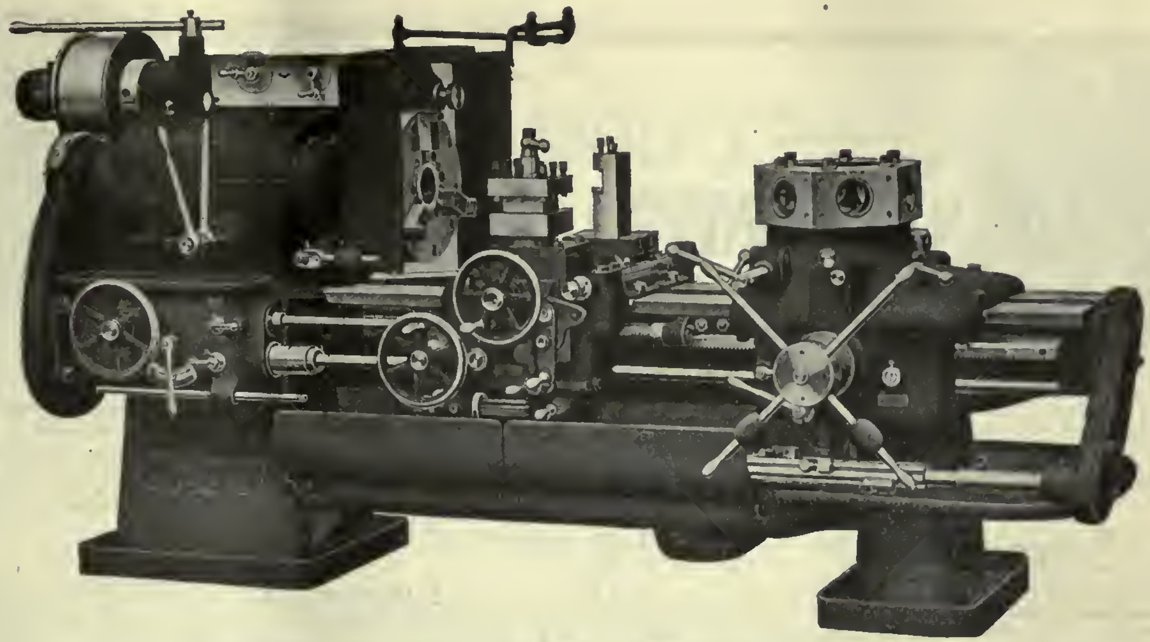


FIG. 2—THE COMBINATION TYPE, WHICH CAN BE USED ON EITHER CLASS OF WORK.

clean up in being machined. to be dealt with without individual resetting of the stops. All lubrication to turret slides and saddles is by outward flow of oil, preventing dirt from working in between these parts and the bed.

The hexagon turret lathes are made in the following sizes, with single pulley drive, bar capacities 1⅝ in., 2 3-4 in., and 3½ in. Maximum length turned, 27 ins. 36 ins., and 42 ins. Diameter of constant speed pulley, 8 ins., 10 ins., 14 ins. Belts, 4 ins., 5 ins., 5½ ins.

Spindle speeds provided, 8, 8 and 16; Feeds provided, 6, 12 and 9.

Combination turret lathes are made in the following sizes with single pulley head—

Swing, 13 in., 16 in., 20 in., 28 in.

Diameter of hole in spindle, 2 in., 2 3-4 in., 3½ in., 6 3-4 in.

Diameter of single pulley, 8 in., 10 in., 12 in., 14 in.

Width of belt, 4 in., 5 in., 5 in., 5 in.

Spindle speeds provided, 8, 8, 16, 16.

Feeds to turret slide provided, 4, 12, 18, 18.

Feeds to saddle provided, 6, 9, 9.

TESTING MACHINE

The Brinell testing machine, as herein illustrated, is known as style A, for 3,000 kilogram pressure, and is placed on the market by the Pittsburgh Instrument and Machine Company, Pittsburgh, Pa., U.S.A.

The Brinell method of measuring the hardness of metals is already well known. A hardened steel ball is pressed into the smooth surface of the metal so as to make an indentation, which is then measured by optical or mechanical means to ascertain the hardness of the material. It was to make measurements by mechanical means that the hardness tester was devised, and it gives direct readings to 1-100 millimeter.

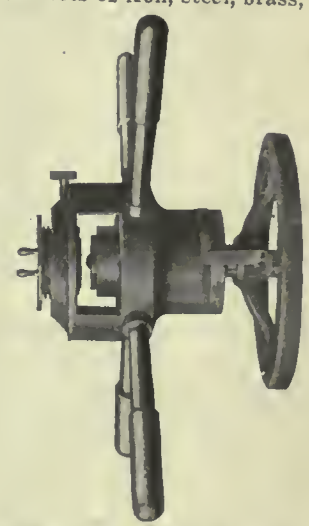
To test metals, the procedure is as follows: After machine has been levelled up and test piece placed in proper position with ball, the pump is brought into action, and a 3,000 kilogram pressure (6,614 lbs.), is created on the piece. Iron and steel are subjected to this pressure for ¼ minute, while softer materials are given about ½ minute.

The diameter of impression is then measured with the aid of microscope, and the corresponding hardness number looked for in the table furnished.

METAL SHEET TESTER

The Pittsburgh Instrument and Machine Co., 101 Water St., Pittsburgh, Pa., U.S.A., have placed on the market their metal sheet tester, as illustrated. This is a machine to determine the drawing, stamping, compressive and folding qualities of sheets of iron, steel, brass, copper, gold, silver, aluminum, nickel, zinc, German silver, and plated metals.

THIS ILLUSTRATES THE STYLE A MACHINE.



THE SHEET TESTER. TO SUIT WIDTH OF ONE-COLUMN WE HAVE TURNED THIS ON ITS SIDE.

In use it shows by a simple operation the workability of metal sheets. In making tests there are two graduations that are observed. One on top of machine is used to measure the thickness of the test piece, and the other, on the lower part of the machine, determines the depth of the indentation.

This machine can also be used for wire tests, a special die and holder being inserted, which permits of tests up to No. 4 B. and S. gauge.

Secured Control.—The American Chain Company has purchased control of the Page Steel and Wire Company, with mills at Monessen, Pennsylvania, and Adrian, Michigan.

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PRINCIPAL CONTENTS

Business Conditions Are Sound

BUSINESS conditions in United States and Canada are fundamentally sound. Circumstances are not the most favorable, and there are many troubles that will not be removed for weeks and months to come. But, allowing for all that, there is nothing of the blue-ruin type in sight.

A representative of this paper attended a meeting of the Editorial Conference of Associated Business Papers in Chicago last week, where business conditions in all the fields represented were discussed by experienced business editors who were in close touch with the trade in their varied fields.

Many of the speakers made the point that the railway situation in United States, following the switchmen's strike, was the root of the trouble. The strike had been a vicious attempt to paralyze the nation's business in the shortest possible way, and for a time success was with the strikers. Canadian industries have a lot of raw material coming from United States. They can look for improvement before long, but the improvement will not be sudden, and it is likely that many months will pass before traffic is passing with the necessary speed between points in the two countries.

One point was brought out that shows a wheel within a wheel, in that the inability of the railroads under present circumstances to transport material to the shops making cars and engines would delay rapid recovery in the railroad problem. In other words, the poor physical shape of many of the roads is making it hard for them to help themselves.

The iron and steel industry has a large volume of perfectly good business on its books. Production is now around 75 per cent. of capacity, but when it is considered that capacity increased some 40 per cent. during the war, it will be seen that 75 per cent. production now is really greater than 100 per cent. capacity in the pre-war days.

The lumber trade reported declining markets, but there were factors that had been in operation to keep the markets from being filled up when these declines were on. Strikes and poor weather had kept the cut down. One expert on the situation claimed that the policy of the larger dealers in a declining market is to force the situation as much as possble and reach bottom at once, depending on past experience of reactions after sharp declines to bring them safely out of any troubles.

The feeling was also expressed that stability could be lent to the present situation in a marked way by a feeling that prices had gone their worst. Of course, there are exceptional cases where this cannot apply. In the main, though, it is worth serious consideration. Several cases were cited where large projects were hung up for the present, because those behind them were not inclined to go into the market for building or equipment, because they knew that costs would be so high that they would be unable to compete with the product of plants that had been built in pre-war times.

Business and banking circles reported that credits were being tightened rather than extended, but they claimed that the general effect was regarded as good. Makers of touring cars were being notified to cut down on their output, while builders of trucks and tractors were being assisted to go ahead. The reason was that the building of the latter would result in a greatly increased area of land being worked on the farms, and thus the new wealth of the country would be added to from year to year.

In all the reports that were delivered, there was nothing to shake confidence, or to cause one to feel that the future had in stire anything that sane commonsense could not surmount.

Knowing Your Business

THE man who knows his business from the foundry to the shipping department has the confidence of the men with whom he does business. It does not take very long to find out if a man knows his own business.

The bluffer can get along for a while, but some day he will face a proposition so big that it cannot be moved by bluff.

A Toronto financier was in an American city a few weeks ago trying to arrange for Canadian rights to a certain process. He asked for information along certain lines regarding costs, profits, markets, etc., and these were given with a thoroughness that impressed the banker at once.

When the matter of production came up the manager of the shop said he could furnish figures for any given period. Just to try this out the banker asked for production from the first of the month. A bell was pressed, and a clerk responded. In turn he received instructions to bring in the shop production figures up to 10.30 that morning. These were produced in about three minutes. At that time it was about 10.45.

Now, there may be shops where this, because of assembled articles, would be impossible. It is possible also to put in a system so cumbersome that it costs more than it is worth to run it.

But the point is this—your banker, your customers, in fact all the people with whom you do business, will be impressed with your proposition in proportion to the degree to which you are master of the situation.

Sykes in the Philadelphia "Evening Ledger."
A Rude Awakening.

MARKET DEVELOPMENTS

Trade Hangs on the Transportation Problem

Recovery is Looked for in Part, but it Will be Some Time Before there is Much Change—The New York Machine Market is a Dull One.

THE manner in which Canadian plants can produce in many lines is measured by the extent to which they can get their shipments of raw material through from United States points. An improvement in transportation should be looked for soon, but it will be gradual, and it will take some time for it to be felt fully. Some of the machine tool dealers in United States are inclined to be critical of the equipment used by their roads to keep up their physical condition, claiming that much of the requirement is fifty years old, and is not fit to do repair work quickly or well.

Some few lines report a better service this week, especially in the importation of steel, but the amount coming through is very small in comparison with the bookings that are piled up against it. Tubes are much needed just now. Plants at this season want to make their repairs, especially in view of the shortage of Hydro power. Very ordinary orders for tubes have been sent all over the country in an effort to have them filled, but with indifferent success. Sizes such as 2", 3", 3½" and 4" are much wanted.

So far, products of the merchant bar mills have been the one bright spot as far as keeping up the steady supplies is concerned, but it is doubtful if the same can be said for bars any longer. Mills that were making good shipments to the Canadian trade find their operations seriously interfered with by reason of the shortage of coal or coke, as well as other shipping facilities, and right now the bar situation is becoming more serious.

There is a good general business moving in machine tools and supplies, although individual orders are not particularly large.

The scrap metal market continues dull and uninteresting. Buyers of steel scrap are not anxious to take on anything in that line. The volume of business in these lines is small at present, and a recovery of the shipping situation is necessary to bring about much improvement.

ABOUT THE WAY NEW TAXES WORK MONTREAL FIRMS ARE NOT SURE

Special to CANADIAN MACHINERY.

MONTREAL, June 10.—There is every reason to believe that the present form of taxation, and the doubt that generally prevails as to the exact interpretation of its application, are among the chief factors that are influencing trade conditions at the present time. The general method seems to be to "pass the buck," in such a way that at each transaction the tax is transferred to the succeeding purchaser, so that in reality, the final customer (or the consumer) foots the bill. In the case of the manufacturer, jobber, and dealer, each has the privilege of passing on the additional cost of the tax—and as the selling price, in each instance, is based on a certain percentage of the cost price, the succeeding costs are increased in proportion, consequently, the final purchaser, while not remitting direct to the Government, is nevertheless paying all the intermediate taxes. As a result of the widely distributed atmosphere of uncertainty, business has become more or less disorganized, and it is the opinion of many that improvement will be much hindered by these conditions.

The soft coal situation has taken on a serious turn here, and some plants have closed down, while others are considering extensive curtailment of operations until more favorable conditions are assured.

Steel Shortage Acute

That manufacturers and jobbers are experiencing continued difficulty in getting material through from the producers, is shown in the falling off in general industrial activity in many parts of the country. "We are advised by officials of our principal mills in the States, that a number of shipments have been on the way for as long as four or five weeks, and that the acumulation of semi-finished steel in the yards is ample to meet present demands of the trade, provided the material could be handled by the railroads." This statement, by a dealer here, reflects the congested state of transportation companies and emphasizes the need of additional rolling stock for the carrying of commodities. It is not entirely a scarcity of cars that has created this condition, but rather the large number of loaded cars that are virtually tied up at different places between the points of shipment and destination. Factories in this district have suffered from insufficient supplies and many will have to consider curtailment in operation in the very near future, unless relief is forthcoming—a hope which at present is shrouded in uncertainty. One shipyard here has reduced operations owing to the non-delivery of steel supplies. Dealers, however, are quite optimistic regarding the summer outlook, but are reluctant to make any definite forecast—an attitude that cannot well be criticized under existing conditions. Minor price adjustments have been made on some lines, but relate more to individual sales than to the general market. Quotations continue firm and nominal.

Little Change in Metals

A passive interest is still displayed in what continues to be an inactive market, the demand for non-ferrous metals being below normal. Railroad troubles in the States and the consequent demoralization of trade in general has tended to quieter conditions and curtailment of output, a natural sequence to restricted supply. The solution appears to hinge on a satisfactory adjustment of operating conditions. Trade, in general, is influenced very largely, by the production and distribution of basic essentials, and when these elements fail to function properly the disturbing effect is at once felt all along the line. With the exception of tin the metal situation remains unchanged. Tin has weakened under increasing supply and restricted demand.

Dullness Continues

Old material movement continues very quiet, and a tendency to lower quotations has developed. So far, however, no concerted move has been made by dealers here to suggest a decline, although it is believed that sales have been made at figures below those quoted. While the present dullness is quite pronounced, some dealers are anticipating a revival of activity when trade becomes more stabilized. Local demand for machinery scrap is comparatively quiet and general sales are below normal. Dealers are not showing any anxiety as they have little to gain by accumulating warehouse or yard supplies. In some instances they are not in the market for certain scraps.

MUCH DEPENDS ON THE RAILWAYS NOW

More Improvement in Them Means Better Output From Many Canadian Shops

TORONTO—The measure of improvement in railway transportation is to a large extent the measure of improvement that will be possible in the Canadian field. Materials are being used up by the factories as rapidly as they come in. The more rapid the income the greater the production of the plant.

The question of the railroad situation, especially in United States, is receiving a great deal of consideration at all hands. One United States expert stated to CANADIAN MACHINERY this week that the roads of that country were in a poorer position to handle freight and kindred shipments now than they were before the outbreak of the war. In this connection there is a peculiar position, in that the poor physical condition of the roads is one of the things that is keeping them from getting help in the way of new rolling stock and new engines. The roads are unable to carry the raw materials to make these things to the shops where they can be built.

Machine tool builders in recent sessions have had much to say about the business of the railroads, from their standpoint. At the convention a week or so ago of machine tool men the statement was made that many of the railway shops were to blame for their own condition, in that they had not kept their own plants up-to-date. Some cases were cited where machinery half a century old was still in operation, and as a consequence the work of repairing or rebuilding was a slow and uncertain process.

Prices of machine tools are remaining around the same mark as has been prevalent during the past few weeks. In one case one firm making presses came down a five per cent. this week. Most of the buying that is being done, and most of the inquiries that are heard of are from small buyers, or for replacement purposes.

Builders of machine tools are largely concerned with the development of export trade. The automotive industries have been keeping up the demand for machine tools, and the tool industry wants to have something else to turn to in case this particular line of manufacturing fails to sustain its present purchasing power. Reports from several sources indicate that bankers favor financing makers of tractors and trucks more than advancing money to makers of touring or pleasure cars.

The Sale of Small Tools

No complaint comes from the makers of small tools in regard to the volume of business that is being done. Several orders during the past few days that were being figured on by several firms went to Old Country houses. Present selling schedules make it possible for the Old Country seller to get in just under the Canadian price, and there is talk of some readjustment to meet this condition. One of the dealers, speaking to CANADIAN MACHINERY this week, seemed to be in favor of boosting up the carbon goods a little and bringing down the high speed to be on a par with the competition from the British houses.

Some Shipments Coming In

Dealers are finding trouble in getting supplies of light gauge sheets. The trade speaks of No. 10 base, which takes in as a general thing from 10 to 16 inclusive. It is hardly possible to get anything outside of 10 and 12. If the 14 or 16 is wanted, then the consumer has to go to some of the light mills and pay the price. One of these mills was offering a certain tonnage to Toronto interests a few days ago. They were asked 8.50c base at mill for light stuff. According to their own explanation they had just finished a mill that was started about three years ago. The estimated cost was $800,000, but by the time the mill was ready to do business it had cost $2,000,000, and the owners were now trying to sell at prices that would help them to recover a share of that money, while there is an incessant demand at high levels. "If you can tell us how we can put up a mill at such an increase over our estimated price and then start at once to sell its production at the same price as mills that were built at a third or quarter of the cost some years ago, I'd like to know the way," was the manner in which the representative outlined their position.

Any tonnage that was booked was only such as could not be secured from other sources. The demand still keeps very keen for anything in the line of steel. Mills show a decided preference for filling orders of the heavier lines, where their tonnage piles up faster.

Merchant bars has been the one bright spot in the market for some time, but it no longer holds that enviable position, as the bar market is fast falling behind and resting with the other overloaded sections. Mills that were doing well by the Canadian trade are having trouble in securing coke to keep their furnaces in operation, and the output is falling off in proportion.

Shipments of tubes are disappointing. The demanded sizes are 2 in., 3 in., 3½ in. and 4 in. Many of these are wanted for the making of needed repairs to existing plants. Several mining companies are placing large orders. Plants realize that electric power is hard to secure in excess of existing allotments, and they are having their steam plants placed in readiness to make the most of the fuel consumed. Nearly every firm handling tubes has a large amount of orders accumulated against any shipments that may come in.

Scrap Still Dull

There is nothing to show a betterment in the scrap metal market. Dealers do not want to buy steel scrap. In fact several of them would be highly pleased to sell some. There is not likely to be much recovery in this line until traffic conditions are such that steel plants can get enough coal or coke to keep their plants in operation.

POINTS IN WEEK'S MARKETING NOTES

Bar mill products are not coming through as freely as formerly. Some mills that were giving the Canadian trade good service are now being embarrassed by shortage of coal or coke.

Boiler tubes are much needed for urgent repair work, while the supplies coming through are small and out of all proportion to the need.

The scrap metal market remains very quiet. Buyers of steel are out for the present and dealers would rather sell than take on more stock.

Some markets in Canada are still rather confused over the new taxation rulings.

Pig iron supplies in Canada are not plentiful, and quotations run as high as $53 and $55.

It is estimated that U. S. mills have over 1,500,000 tons of finished steel stacked at the works waiting for delivery.

The auto trade in the States has cancelled some tonnage of material on the advice of their banks. There is no retarding on the output of trucks and tractors.

ANY CANCELLED ORDERS ARE FOR THE HIGH-PRICED MATERIAL IN AUTO TRADE

Special to CANADIAN MACHINERY.

PITTSBURGH, June 10.—Production of pig iron in May was at the rate of about 35,550,000 gross tons a year, this comparing with rates of 33,650,000 tons in April and 40,050,000 tons in March, the March rate having been the highest since October, 1918. Recovery from the effects of the rail strike and the congestion it produced has been greater than indicated by the mere comparison of the figures, since the rail strike did not greatly affect production until about the middle of April, while production increased during the second half of May. The low point in production may be estimated at somewhat under 30,000,000 tons a year about the third week in April, and the rate at the end of May about 37,000,000 tons. By this time the 40,000,000 ton rate of March is probably closely approached, and before the end of the month that rate may be exceeded, for it is a case now, not of any strike, but of working off the congestion.

Traffic Conditions

The rail strike is practically over, so far as there being left many strikers or "vacationists." The men have either gone back to their own jobs or have secured temporary or permanent work elsewhere, with the exception of groups of men here and there. The railroads may still be undermanned to an extent, in point of numbers, but more important is the point that they have some new recruits, not fully trained to their work. Of much more importance still is the fact that the yards and sidings are congested, and it is slow work making the start to relieve them. After one-third the work has been done, the other two-thirds will be accomplished much more expeditiously.

As to how many cars are out of normal service, either through having gone astray or through still being loaded with freight and not arrived at destination, no estimate can be made, as there is widely variant testimony on this. For instance, of two furnace interests not far apart, one reports that it has a large tonnage of Connellsville coke en route to it, but largely stalled, while another reports that it has very little, hardly as much as the average when traffic conditions are normal.

From all quarters one secures the statement that traffic conditions have been improving, although slowly. There are better supplies of empties all around for loading, but the supplies increase almost imperceptibly from day to day. Movements are somewhat better, and there seems to be more loaded cars received by consignees each day than are dispatched by shippers, but the difference is not very great.

Generally speaking, the steel mills are hardly as yet shipping as much steel as they are making, but there is almost an even break in this respect, and probably there will be within a fortnight. As to moving the accumulated steel, perhaps over 1,500,000 tons all told, that is for the future. There are exceptions, however. One mill is reported to have shipped in the past week twice as much steel as it made, but this is probably a little bit of an exaggeration.

Production

Production of steel, on the whole, has not increased much in the past week or two, but it was not particularly important that it should be, the chief desideratum being to move the steel already accumulated. In the Mahoning and Shenango Valleys, however, where output was greatly restricted, there has been much improvement, and the valleys are now operating, in the matter of making crude steel, at about 70 per cent. of capacity. In the case of the valleys and of some mills elsewhere, not all the steel currently made is being put into material in shape for shipment, as there is accumulation of ingots and of partly rolled steel, it being advantageous to hold steel in such forms rather than carry it to the last degree of finish when it cannot be shipped. As a rule finishing departments can stand some overload, and the partly finished steel can be picked up a little at a time from week to week and carried through.

The rate of steel production may be estimated at about 85 to 90 per cent. of the rate attained in March, which in turn was 85 to 90 per cent. of actual capacity. The percentages refer to steel making rather than steel finishing.

Quiet Markets

The various branches of the finished steel market are quieter, or in other words they are more completely stagnant. There is a moderate volume of business being placed by regular customers of mills for forward deliveries, but this business is chiefly with the Steel Corporation, in whose prices the consumers have confidence on account of their being lower than the independent prices. The independents that are filled with business for from two to four months are not booking a great deal, although they are booking some. As to prompt deliveries, there is now relatively little business done in that line, but there is enough to keep prices from sagging entirely to the price level ruling for deliveries a few months hence. The premiums for prompt shipment are simply declining.

As to cancellations, there are no reports of cancellations except in the case of the automobile trade, which is reported to have cancelled some orders for sheets, also some orders for special grades of cold-rolled steel. Details of these operations are not procurable, but it is quite probable that the cancellations refer to particularly high-priced orders in which deliveries were not made according to contract, the buyers having curtailed their consumption so that they can get along with their regular deliveries, purchased previously at lower prices.

Pig-Iron

Even the most sanguine of the pig iron producers now report that they are doing practically no business. The forward market practically stopped some time ago, but there remained some activity in prompt lots, the demand growing chiefly out of consumers being shut off from their usual sources of supply by the rail strike. Now there is fairly free communication, the merchant furnaces being able to ship to practically all their customers. In the circumstances, market prices are nominal. They are not tested to any extent by actual transactions and lower quotataions are not made, for as a rule the furnaces do not offer iron at cut prices when there is no inquiry. The market remains quotable as follows: Bessemer, $43; basic, $43.50; foundry, $45, f.o.b. valley furnaces, freight to Pittsburgh being $1.40.

Connellsville Coke

Production of coke in the Connellsville region is now running at about 185,000 tons a week, against an average of 245,000 tons a week before the rail strike. The present rates represent a fair gain from the low point. Nearly all the coke is going out on contracts, but even with the limited offerings in the open market foundry coke has weakened a trifle, being now at $15 to $15.50 per net ton, Connellsville ovens, while furnace coke remains at $15, both for spot shipment. Some brokers think that as foundries receive better pig iron deliveries the demand for spot foundry coke will increase somewhat in the next fortnight. Generally speaking, of course, the market is marked for a decline.

NEW YORK TOOL MARKET IS QUIET

Although Some Lists Have Been Issued to the Trade—Railroads are Making Purchases

Special to CANADIAN MACHINERY.

NEW YORK, June 10.—Business continues quiet in machine-tool and allied equipment, though some fairly large railroad orders have been placed and more railroad buying is in prospect. The Atlantic Coast Line has bought about $500,000 worth of shop equipment from its purchasing office at Wilmington, N.C., all of this business going to one company. Other roads which have purchased a few tools each are the New York Central and Long Island Railroad. The Chicago, Burlington & Quincy has placed orders for about $150,000 worth of tools at Chicago, and the Chicago, Milwaukee & St. Paul has an enquiry out for about a dozen machines. The Baldwin Locomotive Works, Philadelphia, is in the market for 18 cranes and a number of machines for locomotive repair work. A large part of the business pending is directly or indirectly due to the needs of the railroads for rolling stock.

The General Electric Co. has issued a new inquiry for abut 30 milling machines of various types, but otherwise there is not much demand for shop equipment from manufacturers. A good many manufacturers in the East have definitely decided to buy nothing but actual necessities for the present, at least. Some plans for expansion of plants will remain in status quo.

Shipping conditions are somewhat better, but many machine-tool plants still have quantities of unshipped tools. There have been a few cancellations of orders due to inability of sellers to deliver tools on schedule time. In some instances shipments are from one to two months overdue.

NOT ANXIOUS TO QUOTE PIG IRON

Dealers Place Toronto Prices Between $53 and $55, with an Indifferent Supply

Dealers in Canada are not anxious to give quotations on pig iron. Between $53 and $55 would be the price asked. As one dealer stated this week: "While we might name a price it is more or less nominal. As a matter of fact we are not all anxious to have you say anything about our business, as we find it hard to look after the business that we already have. Prospects for improvement in the future are not at all bright."

A New York report says that "a material improvement in demand has characterized the pig iron market in this district the past few days and sales which actually have been made, together with inquiries, which are on the point of being closed, aggregate a large total. Numerous large tonnages, making a total of more than 10,000 tons of foundry iron, have been sold, and there are inquiries out for 20,000 to 25,000 tons. Included in the sales were one or two large tonnages for prompt shipment, considerable for second half and a sizable portion for prompt export.

EXPLAIN DELAY IN WORK ON NEW PLANT

Pressed Metals, Ltd., Have New Place Under Way in States—Changes Made in Name

Some delays have taken place in the completion of the American plant of the Pressed Metals Company of Canada, and the situation is explained in the following circular to shareholders just issued:

"On account of the severe winter conditions, coal shortages, strikes, and transportation difficulties that have been prevalent for the greater part of the last six months in the United States, completion of our American plant has been delayed several months beyond calculations.

"Your directors, therefore, at a recent meeting thought it well to advise you of the situation.

"The buildings have been completed, and the machinery and power equipment are now being installed rapidly. Indications point to the commencement of manufacturing of bushings by July, and the operation of the plant to capacity within three months thereafter.

"The intention was to distribute the stock of the International Bushings, Ltd., and the preferred stock of the American Bushings Corporation, after the American plant was operating, but the distribution has consequently been delayed. However, your directors are now very optimistic regarding the operations of the company.

"The organization of the American company, with plant situated on the St. Clair River at Marysville, Michigan, has been completed and will operate under the name of American Bushings Corporation."

GERMAN TRADE NOT RESENTED

Sheffield Despatch Says Their Goods are Often Needed to Fill Out Orders

That British firms are glad enough to get certain lines of German-made goods is the information of one correspondent writing from Sheffield to a British paper. He states: "Importations are increasing, and there is more continuity about the supplies, but, comparatively speaking, the quantities are insignificant. Merchants and dealers, unable to obtain as much goods as their customers want, are eager to get the deficiency made good by any country, and the difficulties of the situation have done much to destroy the prejudice against our late enemy. Germany is at present sending us pen and pocket knives, scissors, manicure instruments, and hair clippers. There has been a big importation of German alarm and wood-case clocks, and these are particularly acceptable, as the home country does not make many such goods, and there is a very acute scarcity of them. Very little enamel and other domestic hollowware is coming from Germany. As this material is extremely dear, some of the large merchants have been visiting Germany for the purpose of getting cheaper supplies, but they found the production very limited. A revival seems to be taking place in the trade in Bohemian and German glassware. Vast quantities of bottles and glass vessels are used in the manufacture of electroplate, and users are doing their best to stimulate trade with Bohemia, which served them so admirably before the war. Deliveries from this source, although increasing, are quite inadequate, as the makers in Bohemia are short of raw materials and fuel."

STEEL TREATERS MEET

The good work of the Toronto Chapter of the American Steel Treaters Society was continued on Tuesday evening, June 1st, when they held their regular monthly meeting at the King Edward Hotel.

The speaker for this occasion was Professor T. R. Louden, of Toronto University. His subject was an extremely interesting one dealing with the Iron Carbon Diagram. He explained the dividing lines between steels and cast iron, the percentage of carbon in these classes of metals, the effects of overheating, how to overcome these effects, and many other phases of interest to anyone interested in the development of heat treatment.

After the lecture was completed, discussion was started, and many interesting points were brought out during this period of the meeting. Past experiences were retold to help others who might strike like difficulties. A motion was adopted to place before these meetings, problems which crop up in the daily heat-treatment work, so that some valuable data will no doubt be arrived at during such discussions.

To those who are not familiar with this society, we might say that the Toronto Chapter of the American Steel Treaters Society, is a body of men interested in heat treatment in all its phases. They meet once a month for educational purposes, and have a very capable speaker for every meeting. You need not be an actual heat treatment man to belong to this society, but if you are in any way interested in heat treatment, then you are welcome.

Mr. A. Lewry, Jr., 282 Lippincott Ave., who is secretary-treasurer of the society, will be pleased to give readers any information they so desire. Write him requesting the date of the next meeting and he will forward you all particulars.

FUEL RESEARCH IN GREAT BRITAIN

A large and well-equipped fuel research station has been established near London, England. It has been designed by the Fuel Research Board, formed under the Department of Scientific Industrial Research, and has been built out of funds provided by the Treasury. Its main object is to carry out large-scale experiments in the low-temperature carbonization of coal with a view to obtaining smokeless solid fuel for domestic and industrial use, gas for power purposes, oil fuel for the navy, and internal combustion engines, and a number of other by-products. Careful arrangements have been made for exact measurements in every step in the treatment. Plant has also been installed for research into the economies of pulverized coal, the utilization of peat, and the production of fuel alcohol. A detailed survey has been made of the qualities of coal available in Great Britain; and the analysis of the samples of coal used in the experiments has been placed on a scientific basis. Important results are expected in the near future.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$42 40
Lake Superior, charcoal, Chicago	57 00
Standard low phos., Philadelphia	50 00
Bessemer, Pittsburgh	43 00
Basic, Valley furnace	42 90
Toronto price:—	
Silicon, 2.25% to 2.75%	52 00
No. 2 Foundry, 1.75 to 2.25%	50 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 50
Steel bars, base, Toronto	5 50
Iron bars, base, Montreal	5 50
Steel bars, base, Montreal	5 50
Reinforcing bars, base	5 00
Steel hoops	7 00
Norway iron	11 00
Tire steel	5 75
Spring steel	10 00
Band steel, No. 10 gauge and 3-16 in. base	6 00
Chequered floor plate, 3-16 in.	8 40
Chequered floor plate, ¼ in.	8 00
Staybolt iron	9 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	4 00
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 67 to 5 50
Small shapes under 3"	3 62

FREIGHT RATES

Pittsburgh to Following Points	C.L.	L.C.L.
	Per 100 Pounds.	
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

	Gross. Montreal	Toronto
Lake copper	$25 00	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	66 00	65 00
Spelter	12 00	12 00
Lead	11 50	11 00
Antimony	14 50	14 00
Aluminum	34 00	36 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 7 25	$ 7 25
Plates, ¼ up	6 50	6 50

PIPE—WROUGHT

Price List No. 44—April, 1920.

STANDARD BUTTWELD S/C

	Steel Black	Steel Galv.	Gen. Wrot. Iron Black	Gen. Wrot. Iron Galv.
⅛ in.	$6 50	$ 8 50	....	....
¼ in.	5 18	7 26	$ 6 43	$ 7 56
⅜ in.	5 13	7 26	5 43	7 56
½ in.	6 84	8 42	7 27	8 84
¾ in.	8 45	10 58	9 03	11 16
1 in.	12 50	15 64	13 35	16 49
1¼ in.	16 91	21 16	18 06	22 31
1½ in.	20 21	25 30	21 59	26 68
2 in.	27 20	34 04	29 05	35 89
2½ in.	43 00	53 82	....	....
3 in.	56 23	70 38	....	....
3½ in.	71 30	88 32	....	....
4 in.	84 48	104 64	....	....

STANDARD LAPWELD S/C

	Steel Black	Steel Galv.	Gen. Wrot. Iron Black	Gen. Wrot. Iron Galv.
2 in.	$30 90	$37 74	$34 60	$41 44
2½ in.	45 34	56 16	51 19	62 01
3 in.	59 29	73 44	66 94	81 09
3½ in.	73 14	90 16	82 34	99 86
4 in.	86 66	106 82	97 56	117 72
4½ in.	0 98	1 23	1 24	1 49
5 in.	1 15	1 44	1 44	1 73
6½ in.	1 49	1 86	1 87	2 25
7 in.	1 94	2 43	2 42	2 90
8-L in.	2 04	2 65	2 54	8 05
8 in.	2 85	2 94	2 92	8 61
9 in.	2 81	3 52	3 50	4 21
10-L in.	2 61	3 26	3 25	3 90
10 in.	3 36	4 20	4 18	5 03

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.

4½" and larger 50%.

4" and under, running thread, 30%.

Standard couplings, 4-in. and under, 30%

Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices.

Per 100 Pounds.	Montreal	Toronto
Copper, light	$15 00	$14 00
Copper, crucible	18 00	18 00
Copper, heavy	18 00	18 00
Copper wire	18 00	18 00
No. 1 machine composition	16 00	17 00
New brass cuttings	11 00	11 75
Red brass cuttings	14 00	15 75
Yellow brass turnings	8 50	9 50
Light brass	6 50	7 00
Medium brass	8 00	7 75
Scrap zinc	6 50	6 00
Heavy lead	7 00	7 75
Tea lead	4 50	5 00
Aluminum	19 00	20 00
	Per Ton	Gross
Heavy melting steel	18 00	18 00
Boiler plate	15 50	15 00
Axles (wrought iron)	22 00	20 00
Rails (scrap)	18 00	18 00
Malleable scrap	25 00	25 00
No. 1 machine east iron	32 00	33 00
Pipe, wrought	12 00	12 00
Car wheel	26 00	26 00
Steel axles	22 00	20 00
Mach. shop turnings	11 00	11 00
Stove plate	26 50	25 00
Cast boring	12 00	12 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅝-in. and less	10
Carriage bolts, 7-16 and up	Net
Coach and lag screws	25
Stove bolts	55
Wrought washers	45
Elevator bolts	Net
Machine bolts, 7/16 and over	Net
Machine bolts, ⅜-in. and less	15
Blank bolts	Net
Bolt ends	Net
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square, blank	add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 50
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	25 and 5
Sq. and hex. hd. cap screws	22½
Rd. and fil. hd. cap screws	plus 17½
Flat but. hd. cap screws	plus 30
Fin. and semi-fin. nuts up to 1-in.	20
Fin. and Semi-fin. nuts, over 1 in., up to 1½-in.	10
Fin. and Semi-fin. nuts over 1½ in., up to 2-in.	Net
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$60 00
Open-hearth billets	60 00
O.H. sheet bars	76 00
Forging billets	56 00-75 00
Wire rods	52 00-70 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 70
Cut nails	5 85
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 35½
British Manila rope	0 28
New Zealand hemp	0 28
Transmission rope, Manila	0 47
Cotton rope, ¼-in. and up	0 88

POLISHED DRILL ROD

Discount off list, Montreal and Toronto .... net

MISCELLANEOUS

Solder, strictly	$ 0 40
Solder, guaranteed	0 43
Babbitt metals	18 to 70
Soldering coppers, lb.	0 62
Lead wool, per lb.	0 16
Putty, 100-lb. drums	8 30
White lead, pure, cwt.	20 00
Red dry lead, 100-lb. kegs, per cwt.	16 50
Glue, English	0 40
Tarred slater's paper, roll	1 30
Gasoline, per gal., bulk	0 35
Benzine, per gal., bulk	0 35
Pure turp., single bbls., gal.	3 60
Linseed oil, raw, single bbls.	3 00
Linseed oil, boiled, single bbls.	3 03
Sandpaper, B. & A.	List plus 43
Emery cloth	List plus 37½
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04¼
Rosin, "D," per lb.	0 14
Borax crystal and granular	0 14
Wood alcohol, per gal.	2 70
Whiting, plain, per 100 lbs.	2 75

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes	32½
Can. carbon cutters, plus	20
Standard drills, all sizes	32½
3-fluted drills, plus	10
Jobbers' and letter sizes	32½
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	net
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus 20 to	40
Can. high speed cutters, net to plus	10
American plus	40

COLD ROLLED STEEL

[At warehouse]

Rounds and squares	$7 base
Hexagons and flats	$7.75 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	60	75
Class B	27	37
Class C	18	27

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 8 50	$ 9 50
Sheets, Blue ann., No. 10	8 50	9 00
Canada plates, dull, 52 sheets	8 50	10 00
Can. plates, all bright	8 60	9 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	11 00	....
Fleur-de-Lis, 28 B.W.G.	10 50	....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28	....	....
Premier, No. 28, U.S.	11 50	10 50
Premier, 10¾-oz.	11 50	10 90
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅝ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	29 50
1¾ in.	31 50	30 00
2 in.	35 00	30 00
2¼ in.	35 00	29 00
2½ in.	42 00	37 00
3 in.	50 00	48 00
3¼ in.	.. ..	48 50
3½ in.	63 00	51 50
4 in.	85 00	65 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	24½
Palacine	27½
Machine oil, per gal.	43½
Black oil, per gal.	18½
Cylinder oil, Capital	82
Cylinder oil, Acme	70
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	$2 60
Union thread cutting oil, antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil, bbls., net	13½

BELTING—No 1 OAK TANNED

Extra heavy, single and double	10%
Standard	10%
Cut leather lacing, No. 1	2 75
Leather in side	2 40

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 60
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	09
Pumice, ground	06
Emery glue	30
Tripoli composition	09
Crocus composition	12
Emery composition	10
Rouge, silver	60
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE

XXX Extra	.24	Atlas	.20
Peerless	.22½	X Empire	.19½
Grand	.22½	Ideal	.19
Superior	.22½	X Press	.17½
X L C R	.21		

Colored

Lion	.17	Popular	.13
Standard	.15	Keen	.11
No. 1	.15		

Wool Packing

Arrow	.35	Anvil	.22
Axle	.28	Anchor	.17

Washed Wipers

Select White	.20	Dark colored	.09
Mixed colored	.10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades... 15%

ANODES

Nickel	.58 to .65
Copper	.38 to .45
Tin	.70 to .70
Zinc	.18 to .18

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10..		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6 x 4 base	45 00	44 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 75	$14 50
Sheets, 3½ lbs. sq. ft.	10 50	14 00
Sheets, 4 to 6 lbs. sq. ft.	10 25	13 50

Cut sheets, ½c per lb. extra.

Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .23
Acid, hydrochloric	.03¼
Acid, nitric	.10
Acid, sulphuric	.03¼
Ammonia, aqua	.15
Ammonium, carbonate	.20
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, annhy.	.41
Copper, sulphate	.16
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.08
Nickel carbonate	.32
Nickel sulphate	.19
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.25
Silver nitrate (per oz.)	1.20
Sodium bisulphate	.11
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.18
Tin chloride	1.00
Zinc chloride, C.P.	.30
Xinc sulphate	.08

Prices per lb. unless otherwise stated

Points Considered by the Purchasing Agent

Standing and Ability of the Vendors to Produce the Material Considered as Governing Factors—Equipment Has to Be the Best to Get the Desired Quality in the Product.

ALTHOUGH devoted to the purchase of gears, points equally applicable to the purchase of other materials were set forth in a paper on "Gears from a Purchaser's Standpoint" presented by G. D. Stanbrough, general superintendent Packard Motor Car Co., Detroit, at the recent convention of the American Gear Manufacturers' Association, Detroit. "When you undertake the purchase of any article from rough stock to finished parts," Mr. Stanbrough said, "the first question that comes to mind is the standing and ability of the vendors of the special commodities which you are purchasing. Your chances of selecting a satisfactory source of supply is governed by the following general conditions:

1. The personnel of the organization.
2. Their financial support.
3. Their general business reputation.
4. The location of the plant to sources of supply and transportation centres.
5. General business ability.
6. The labor market.
7. The general character of the plant buildings.
8. The character of their equipment.

"We cannot underestimate the value of weighing all these considerations. I will discuss them in the order named, briefly.

Plant Personnel and Reputation

1. It is a well-known fact that no firm nor the product that they make is any greater than the men that make up that business. An organization to machine and manufacture successfully should be made up of men who are good mechanics, whose reputations have stood the test of time for doing good work. Men who know the proper methods to be used and have courage enough to use them. The organization from a personnel standpoint should be well balanced— should include a good business man, good mechanical talent and a good engineer.

2 We cannot underestimate the value of ample financial resources. Such resources will relieve the men who are in charge of operations from worries and allow them to put their efforts on the production. Adequate finances permit the purchase of stock in different quantities to insure a steady flow of product, and this is particularly necessary in the manufacture of gears where many operations and much time is consumed. The firm that is handicapped for money to meet stock bills and to pay the payroll cannot be counted upon to produce with the same steadiness as can be expected under more propitious circumstances.

3. The only thing that we can tell about a firm or an individual, with any degree of certainty, is his record of past performances. Business ability is reflected in the stability of the organization. The prosperity of a company embraces its standing in a community and the reaction as apparent from personal contact with the representative of the firm in business traansactions. It is reflected in the measure of good judgment that is shown by a firm's past record in handling contracts under similar conditions.

4. I think the importance of this subject (location of the plant to sources of supply and transportation centres) is self-evident; other things being equal, it is much better for a firm to deal with one in its immediate vicinity in order to minimize the transportation difficulties of the present time. However, under various circumstances it may be more advantageous to deal with a firm that is close to a base of raw material. These are matters that have to be weighed and judged in each individual case.

5. A firm's business connections and contracts which it has established with vendors of raw material are an important consideration in these times when sources of supply are contracted for many months ahead.

Labor Conditions and Plant Equipment

6. We all realize that under present-day conditions the labor market has an important bearing upon a firm's ability to meet the promises as to production. The labor market has got to be viewed first from the standpoint of supply; (2) From the standpoint of the quality of the supply; (3) From the reputation of the people in the community on questions of strikes and other labor disturbances; (4) With reference to housing and general sociological conditions, affecting the welfare and happiness of the community.

7. This (the general character of the building) has particular reference to fire protection, fire underwriter's risk, plant lay-out to facilitate good manufacturing, arrangement of machinery for economical production, and satisfactory working conditions from a labor standpoint.

8. We have put this subject (character of equipment) last in order, but it is by no means last in importance. Good gears can only be produced by modern machinery properly installed, properly maintained and satisfactorily operated. An adequate supply of cutters, hobs, and high-speed steel for blading and the necessary assortment of small tools should be on hand. Machines should be placed to permit operation with a minimum amount of vibration. Wherever possible, grinding machinery should be placed on the ground floor. When we are manufacturing gears, we are working within narrow limits, and it is fruitless to suppose that satisfactory results can be obtained in the face of poor equipment and installations. It should be borne in mind that in these modern times heat treatments have a large part in the satisfactory finished product, and the plant that manufactures gears from carbon and alloy steels must contain modern heat treatment equipment, and a thoroughly experienced metallurgist in charge of its operation. We don't want to overlook the fact that the metallurgical end of the business is highly scientific and is based upon exact knowledge and cannot be satisfactorily performed by rule of thumb methods without the use of proper standards of comparison.

"Having settled to our satisfaction that the proposed source of supply fulfills a large number of the above requirements, we are next confronted by the fact that satisfactory gears from a purchaser's standpoint can only be produced as a result of conformity to good practice along the following lines: Design, materials, forgings and castings, heat treatment, machining, hardening and inspection."

After discussing these points in detail the speaker concluded that "satisfactory gears cannot be produced by any but the most painstaking efforts, and the higher requirements for the elimination of gear noises the more we are confronted by the fact that we have much to learn and from a purchaser's standpoint a knowledge of what is possible under present-day methods is necessary in order that purchasing requirements may be reduced or may be made to coincide with the present state of the art."

HERE ARE SOME RULINGS MADE

Many Points are Coming Up That Require Special Information for Dealers

Sales to Consumer by Manufacturer, Wholesaler or Jobber.—The Department of Inland Revenue has ruled that goods or material sold by a manufacturer, wholesaler or jobber to a consumer are subject to the sales tax of 1 per cent., and also to the tax set forth in Section 1 of the Resolutions, where the articles sold are subject to such excise tax.

Manufacturers Who Purchase Goods for Resale.—The department has ruled that where a manufacturer purchases supplies and other articles as jobbers resale, the sales tax of 1 per cent. applies to such goods when sold.

Contracts Entered Into Prior to May 19th, 1920.—On contracts entered into prior to May 19th by manufacturers, wholesalers or jobbers, for the delivery of goods or material and which contracts had not on that date been completed by delivery, the sales tax of 1 per cent. will apply in respect of all shipments or deliveries made after May 18th. The sales tax of 1 per cent. should, according to the ruling of the department, be added to the invoices covering such shipments made after May 18th.

A GOOD BOON

"Geometric Tools are a good boon in our business. Always reliable and sure of turning out a class job; in fact, I don't know how we could secure a decent output without them."

This is what the Works Inspector of a London (England) shop says. He adds that they are making screw and small parts for air craft, and have quite a lot of Geometric Dies in constant use.

Because of the fact that Geometric threading tools are "a good boon" in the thread cutting business, the majority of screw machines and turret lathes are equipped with Geometrics.

THE GEOMETRIC TOOL CO.
NEW HAVEN, CONN.

Canadian Agents:

Williams & Wilson, Ltd., Montreal
The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg and St. John, N.B.
Canadian Fairbanks-Morse Co., Ltd., Manitoba, Saskatchewan, Alberta

For any thread, any size, any pitch,—there's a Geometric Collapsing Tap or Self-Opening Die Head. Be assured there is one to meet your particular threading need—whatever it may be. Ask us.

INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS PERSONAL AND TRADE NOTES

TRADE GOSSIP

Two by-laws were emphatically endorsed by Brighton citizens. The vote for the Barnard Machinery Co. carried, with 275 voting for and 6 against it, and that of the Dominion Canners with 276 for and 7 against it.

Montreal.—Through the inability of the company to procure castings, the Canadian Vickers Co. have been compelled to lay off nearly five hundred men. The shortage is due to labor troubles at Warden King's and the Montreal Locomotive Works, which firms supply the Vickers Co. with their castings.

Advised to Cut Production.—The secretary of the United Mine Workers, after receiving word from the Minister of Labor refusing the request of the men for a collective board to consider grievances, suggested to the men that one way to bring the owners round was to decrease production 50 per cent. The suggestion was not acted upon, and several other proposed expedients were turned down.

To Build Viaduct.—The proposed railway viaduct along the Toronto waterfront will be proceeded with at an early date, if the civic authorities get their wish. A meeting between the Board of Control and the Harbor Commissioners will be held shortly, and an application made to the Railway Board to compel the railways to proceed with the work.

Dominion Briquette Research. — The Government's lignite briquetting plants established by the Research Council to produce lignite fit for consumption, will be producing by August. It is the opinion of Dr. A. B. Macallum that the new fuel will prove so much cheaper and more efficient than anthracite, that the market for the latter in Western Canada will be closed, and private capital attracted to the lignite fields.

Receiving Tenders.—The Toronto Electrical Commissioners will receive tenders until Wednesday, June 16, for building a sub-station on Ossington Avenue, near St. Clair Avenue, including excavation, masonry, structural steel, etc., roofing, plumbing, painting and such other work required for a completed building. Tenders must be accompanied by a marked cheque. Forms for tenders may be obtained from the purchasing agent. or the Engineering Department at Station D, corner of Duncan and Nelson Streets, Toronto.

Duluth.—Arguments in favor of the proposed deep waterway from the lakes to the sea were heard at the final hearing of the International Joint Waterways Commission. It was stated that a channel to the sea could be completed in shorter time than the Eastern Atlantic ports could improve their facilities. The commission will hold sessions at Superior, Wis.; Ashland, Wis.; Milwaukee, and finish up at Toledo.

Vocational Training in Manitoba.—The Manitoba Government are considering the establishment of vocational training centres for young men and women, for training in various branches of industry and home economics. The Government has decided to participate in the Federal Government's $10,000,000 fund for technical education, and to embark on a vigorous programme in that connection.

St. Catharines.—The Niagara, St. Catharines and Toronto Railway are proposing to put their new steamer Northumberland on the Toronto and Port Dalhousie route about the middle of June. The Northumberland, which is a steamer of 220 feet length, built in Newcastle-on-Tyne in 1894, will make the trip in about 1½ hours. She has been engaged in the North Atlantic Coast passenger traffic.

CANADIAN FAIR IS NOW OPEN IN LONDON

Many Firms From the Dominion Are There—Developing the Export Trade

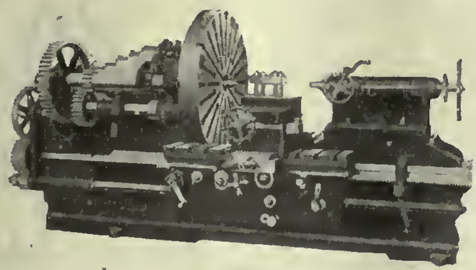
London.—The first Canadian Trade Exhibition ever held in Britain opened on Wednesday in the Agricultural Hall, London. A number of exhibits arrived late, and although the British customs authorities agreed to expedite the unloading, it has been found impossible to do so as the result of incorrect invoicing of some shipments. The exhibition, however, will afford an object lesson of wide range of present-day Canadian trade. It includes Canadian products varying all the way from a motion-picture projector to folding beds A Montreal ready-made clothing firm, apparently unimpressed by the competition of the world's woollen centre, Manchester, has an exhibit of ladies' and children's garments, and other firms are showing wall papers, tractors, spark plugs, washing machines, chemicals, tools, steels, enamelware, chocolates, and other products of divers kinds. The Dominion is now a larger exporting country than France and Japan, or Italy, Spain and Holland combined.

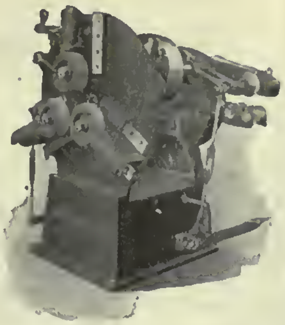
Brockville.—Catching fire at the wharf of the New York Central Railway, at Morristown, the steamer "H. P. Bigelow," owned by the Morristown-Brockville Transportation Co., was totally destroyed. The fire burned the steamer's mooring lines, and she drifted away from the wharf out of reach of the fire department's hose. She burned to the water's edge and then sank. Another vessel will be purchase to carry on the service.

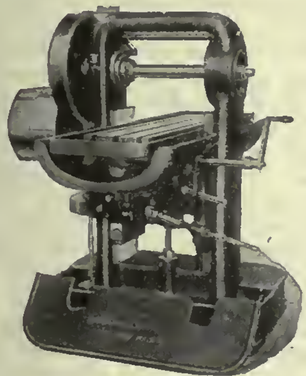
The MacKinnon Steel Co., Limited, Sherbrooke, Que., have recently received the following contracts: Oil storage tank, 8 ft. x 32 ft., for town of Moosomin, Sask.; steelwork for new Jewish Synagogue, Montreal Street, Sherbrooke, Que.; structural steel work for Weedon Power Station, City of Sherbrooke; steel superstructure for bridge over Tartigou River, Gaspe Co. H. Lepage & Freres are the general contractors.

Secures Coal for Gas.—The Fuel Commissioner, Mr. H. A. Harrington, has returned from a trip to the U.S. coal mine areas, where he has been successful in arranging for some deliveries. At the same time companies are urged to practise conservation. The firms for whom deliveries were secured include the Ottawa Gas Company, the Hamilton Gas Company, and the Consumers' Gas Co. of Toronto. A train-load was also secured for the Chatham-Windsor district, and also barge loads for Toronto and Sarnia, as well as 2,000 tons of anthracite.

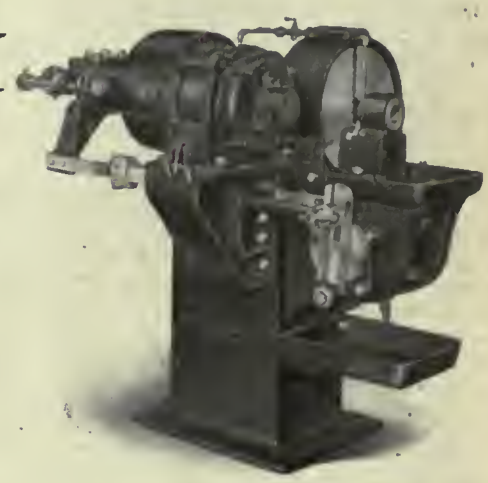
The Canadian Fairbanks-Morse Co., at their Toronto office, have installed an ingenious "in" and "out" directory, covering all department managers i nthe building. It is situated conveniently just outside the front door on the main floor, the offices for the most part being upstairs. Yellow and blue lights are used. When a member of the staff comes in he shoves a button and his name will show up in yellow. When he goes out he shoves again and a blue light appears under his name. The meaning of the colors is explained at the top of the directory. A glance at the board will







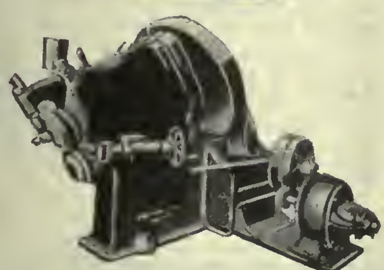
PARTIAL LIST OF MACHINERY
IN TORONTO STOCK

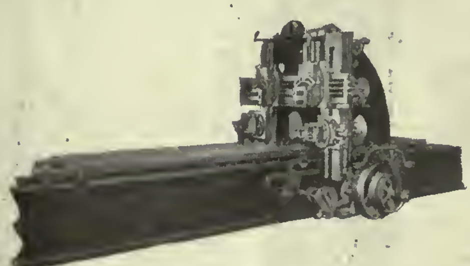


2 7 "A & B" Cataract Precision lathes.
1 18x8 Roe, D.B.G. & G.C.G., engine lathe.
1 18x8 Milwaukee, D.B.G. & G.C.F., engine lathe.
1 24x10 Milwaukee, D.G.B., G.C.F., engine lathe.
1 36x18 Putnam engine lathe.
1 20x38x12 C.M.C., Exp. engine lathe.
1 16" Edlund H.S. drill.
1 20" Barnes drill press.
2 20" Champion drill press.
1 No. 314 Baker, 3" capacity.
3 4-spindle Woodward H.S. drills.
1 16" Queen City shaper.
1 24" McGregor or Gourlay shaper.
1 24" Steptoe single pulley drive shaper.
1 30x36x12 London planer.
1 8x36 Fitchburg Plain Cylindrical grinder.
1 No. 3 Ryerson Owen Universal grinder.
2 No. 3 Ford Smith plain miller.
4 Briggs Millers, 20 to 42" traverse.
1 Ryerson No. 3 Rotary Bevel Shear 1" capacity.

Cleveland, National, Acme & Brown & Sharpe Automatic and other machines for all purposes.

May we have your enquiries?





Garlock-Walker Machinery Company, Limited

32 Front Street West

MONTREAL **TORONTO** WINNIPEG

"Everything in Woodworking and Metal Working Machinery"

If interested tear out this page and place with letters to be answered.

show at once if the party you desire to see is in or out.

Changes at Galt.—Wells Bros. Company of Canada, Limited, are about to change their name to the Greenfield Tap and Die Corporation of Canada, Limited, this being the same name as the parent concern at Greenfield, Mass. At the same time, they are increasing their capital from $40,000 to $250,000 and will very shortly increase their manufacturing space by more than double the present capacity. This is necessitated by the ever-increasing business.

Brantford Shop Extends.—Dominion Steel Products, Brantford, are building a large steel and brick pattern shop to take care of the additional demand for patterns brought on by the recent completion of their grey iron and brass foundry. Their foundry is equipped with a 20-ton air furnace, used especially for the manufacture of all classes of chilled cast iron rolls, and other high-grades of close-grained iron castings. In addition to the air furnace, the foundry is equipped with two cupolas of an hourly capacity of 12 tons, and an electric brass furnace of 1,000 pounds capacity. This company at present is engaged in the manufacture of rolling mill equipment, the heavier rubber working machinery, all classes of drive, line and propeller shafting, and are the manufacturers of the Dominion Herringbonegear, cut under the Fawcus patents. The company has recently developed, and has now ready for the market, a heavy oil engine of the Diesel type of 120-horse power, which may be used independently or directly connected with a generator.

PERSONAL

Mr. Beverley H. Neill, sales manager and secretary-treasurer of the Canada Machinery Corporation, Ltd., Galt, is at present en route for Vancouver on the special C. M. A. train, to attend the Canadian Manufacturers' Annual Convention.

CATALOGUES

TECHNICAL BOOK CATALOGUE

The D. Van Nostrand Company, 8 Warren St., New York, have now issued their 1920 catalogue on technical, industrial, engineering and scientific publications. The book is very complete, and as stated by this company, the list therein contains, in their judgment, only books from standard authorities on the respective subjects. They even go so far as to state that money will be refunded, if after ten days the purchaser is not satisfied.

To go into all the subjects in this short space is impossible, as the catalogue contains 256 pages, but enough to state that the chemical, paint, paper, textile, electrical, mechanical, structural, machine shop and other varied fields have been covered very completely.

As we understand it, a copy of this catalogue can be obtained free by mentioning this announcement, and to all interested in technical literature, we can safely recommend its use.

NEW CATALOGUE

The L. Best Company, 28-30 West Broadway, New York, have issued their 1920 catalogue on grinding machines, wheels and supplies. In addition to a description of their lines they give various tables and data of considerable importance.

BRANTFORD FIRM SOLD THE BUSINESS

Brantford Emery Wheel Co. Has Been Bought Out by the Waltham Grinding Wheel Co.

Brantford.—Recent transaction places the control of the Brantford Emery Wheel Company, Limited, in the hands of those whose interests are identical with the Waltham Grinding Wheel Company of Waltham, Massachusetts. The Brantford Company has been operating for the past ten years in the manufacturing of grinding wheels and it is felt that the new interests will enlarge immediately production facilities and be a factor of service to the grinding wheel users of Brantford and other parts of Canada.

Colonel Frank A. Howard is to continue as managing director.

The Waltham Grinding Wheel Company is one of the oldest and largest companies of the United States, the originators of the so-called elastic wheel process and have a record of 50 years of service and quality.

The new owners expect to greatly enlarge their production at Brantford.

BRITAIN TRADES WITH RUSSIA NOW

Working Agreement Reported to Have Been Arrived At in London

London.—An agreement for the resumption of trade between Great Britain and Russia was concluded at a meeting to-day between Premier Lloyd George and other Ministers, and Gregory Krassin, Russian Soviet Minister of Trade and Commerce. While no official report was issued after the two-hour meeting, it is said on good authority that an agreement was definitely concluded.

Under the terms of the agreement individual commercial concerns will immediately begin dealing with Russia, which, it is said, would draw to England $300,000,000 in gold now in Moscow. The only control over the transactions which will be held by the Government, will be the granting of permits to companies wishing to trade with Russia, it was said.

The consummation of the agreement was regarded in business circles as the most notable commercial and financial victory since the end of the war.

—Kirby in the New York "World."

POINTING THE WAY


ATKINS
METAL CUTTING SAWS
Solve your Metal Cutting problems, easily, quickly and economically, by adopting the products made by
ATKINS
We make Kwik-Kut Power Hack Saw Machines which use practically the full cutting edge of the Hack Saw Blade at each stroke; Metal Cutting Band Saw Machines for general shop work, cutting all classes of metal up to 12 x 14 inches.
Your requirements for Metal Cutting Circular Saws can be supplied promptly and we solicit a trial of our "AAA" Non-Breakable and Power Hack Saw Blades and Frames.
"A Better Saw for Every Use"
E. C. Atkins & Co.
Established 1857
"The Sterling Quality Saw People"
Factory: HAMILTON, ONT
Branch: VANCOUVER, B C.
THE FINEST ON EARTH

The Week's Events in Montreal Industry

The Hyde Engineering Works of Montreal are open to take on some good manufacturing line. They have a well-equipped plant and have a long experience in engineering activities.

Robt. Dawson, for the past two years with Peacock Bros., of Montreal, in charge of the instrument repair department, has accepted a position with McGill University, and will have charge of maintenance of all scientific instruments.

Owing to the irregular delivery of steel plates and shapes, the shipbuilding plant of the Canadian Vickers Company has been operating below capacity, and curtailment of activities has necessitated the temporary suspension of some of the workmen. These men will be taken on again immediately the accumulation of material warrants it.

Owing to the general scarcity of soft coal in this district, which has become additionally pronounced during the past week, the National Brick Company of Laprarie has had to suspend operations. Other materials are plentiful, but the delivery of coal in operating quantities has fallen off tremendously during the past several weeks.

Hans Renold, of Canada, Ltd., have opened their offices in the Marconi Building, 11 St. Sacrament Street, Montreal. This company was recently organized to be the sole Canadian representatives of the Hans Renold Ltd., of Manchester, England, so that dating from June 1, all enquiries regarding Renold steel driving chains and wheels should be made to the above address. Mr. H. George, formerly with Jones and Glassco, will be the managing director.

Negotiations have been going on for some time, whereby the Canadian Explosives, Ltd., will absorb the Dominion Copper Products, and it is expected that the deal will be closed this week, at a special meeting of the Copper Company's shareholders. The Dominion Copper Products Co. was created during the war for the manufacture of brass for cartridge cases, and copper for rifling bands. Since the close of the war the plant has been actively engaged in meeting the demands for domestic copper and brass products.

The City of Montreal has just closed a contract with the Montreal Light, Heat, and Power Company for power to operate the electric units that will be used for the pumping of water at the Low Level Pumping Station. The contract is for a minimum amount of 4,000 horse-power at a maximum rate of $25, the period of the agreement to be 25 years. This is the result of negotiations that have been carried on for some time in connection with the installation of motor-driven pumps in place of the steam ones now in use. Two of the new five 30 million-gallon pumps that will eventually be provided are expected to be in operation this summer.

The fortieth annual convention of the American Federation of Labor, which is being held this week in Montreal, at the St. Denis Theatre, is now in full swing, and additional delegates are arriving daily. It is expected that upwards of 1,000 labor representatives from all parts of Canada and the United States will be in attendance. President Samuel Gompers arrived in the city last Friday to prepare for the week's activities. In commenting on the work before the convention, Mr. Gompers said: "We have great economic questions to deal with in the United States, problems that require constant study and wise handling. These include the bettering of the conditions of the toilers, the reduction of the alarming cost of living, the crushing of profiteering. You have the same problems in Canada, so, much as our presence is needed in the United States, we could not refuse your invitation to come here and help to solve your difficulties and to lend a hand in trying to arrange a basis of common action that would help to improve the conditions of Canadian workers, be of benefit to them all round, and at the same time not inflict grievances or hardships on the employers of this and the sister country."

The effects of the shortage of coal are already becoming painfully evident in various Montreal industries, a number of which are closed down for want of fuel while many others are only able to keep going by exercising the greatest economy. Complaints were heard last week-end in the hardware trade that manufacturing firms had ceased operations for this reason. Now comes the report that the National Brick Company, of Laprairie, has ceased burning. Coal, they say, is being received in small quantities, but not enough to make any impression on the accumulation of orders they have on hand. For some weeks now they have been fulfilling orders from stock only, but this is rapidly coming to an end. Ample materials are on hand, otherwise, and everything is ready to resume burning on a large scale as soon as the supply of coal becomes available.

SCRAP RECOVERING AROUND CHICAGO

But It May Be Some Time Yet Before Buying Will Be Done in Any Quantity

Chicago.—Efforts to clean up congestion in railroad terminals and to speed up the movement of freight all along the line are begining to produce results. Scrap is moving a little more freely and trade is hopeful that the transportation problem will soon cease to be the deterrent factor in business that it has been for several weeks past. At the same time it is understand that much work is yet to be done before the jam is loosened at every point and a prompt and orderly freight service restored. The important thing, however, is that progress to that end is being made under definite plans and co-operative effort, which, barring further arbitrary action on the part of the railroad brotherhoods, can be counted on to set the traffic system in motion again.

Consumers of melting steel are at last beginning to show some interest in the market, and although no buying of importance has yet been reported, a few minor transactions serve to give some line on prices, which for heavy melting steel range from $22 to $22.50 and $21.50 to $22 for shovelling steel. Prices in wrought and other grades show little change and no indication of further decline, except in stove plate and machine shop turnings, which are off about a dollar a ton from last quotation.

Dealers complain that on the basis of present labor costs for working and handling scrap, the higher freight rates, there is no money in scrap at present prices. If that is the case, any further decline can only come as a result of forced sales to realize on stock in hand.

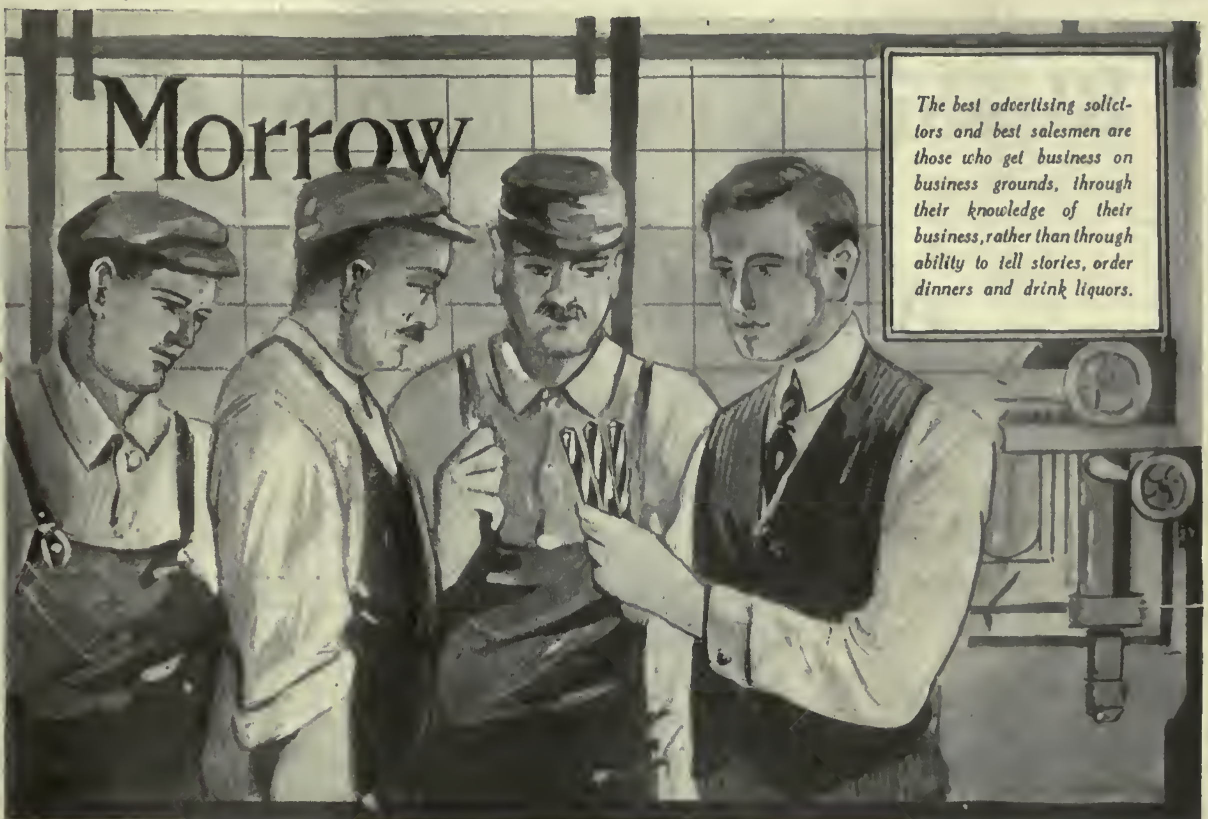
Stocks in dealers' yards have been accumulating for some time and a larger proportion than usual is sorted and worked up for shipment, so that the probabilities are that when demand opens up, it will be met by plentiful offerings.

APPROVE IDEA OF PREFERENCE TARIFFS

What the C.M.A. in Its Annual Meeting Has to Say Regarding This Matter

The Canadian Manufacturers' Association, at its meeting in Vancouver, in the annual report, made the following reference to the tariff:

"The position of this association in regard to the Canadian customs tariff was clearly defined at the last anual meeting, where a resolution was passed advocatcapacity to the Government. We see no reason why this resolution should of experts who would act in an advisory capacity to the Government. do not see any reason why this resolution should not be reaffirmed at this meeting. The objects of the fiscal system of Canada should be to diminish, as far as possible, the buying of goods from other countries which can be produced here; to facilitate the importation of raw materials which cannot be produced at home; to export our own materials in the shape of finished products, and to make Canada as self-contained as possible by developing and encouraging activities which will give occupation to our citizens. The association last year also went strongly on record in favor of tariff preference among the various countries constituting the British Empire. The war strengthened the ties which bind the Empire together, and we believe these ties would be further strengthened by the extension of imperial preferential tariffs."


Morrow
The best advertising solicitors and best salesmen are those who get business on business grounds, through their knowledge of their business, rather than through ability to tell stories, order dinners and drink liquors.

The

Blashill Wire Machine Co.

Limited

ANNOUNCEMENT!

We Beg to Announce the Opening of Our Machinery Salesroom and Offices at 307 ST. JAMES STREET, MONTREAL

(Just West of Victoria Square)

We will specialize in the better classes of used machine tools, and in machines rebuilt with exceptional care in our own machine shops. Sales will be made subject to a liberal guarantee. Large stock of lathes ranging from 14" to 36" swing, also grinders, millers, turret lathes, drills, etc., also—

SPECIAL!

50 K.W. 120-125 Volt D.C. Bullock 300 r.p.m. Engine (12x12)—Generator set—direct connected and mounted on heavy cast base, marble switchboard instruments and rheostat complete—A 1 condition

5 ft. Cincinnati Bickford Radial Drill a Fine Machine.

THE BLASHILL WIRE MACHINERY CO.

LIMITED

Sales Rooms and Offices:
307 St. James St.
MONTREAL

Machine Shops:
182 Shearer St.
MONTREAL

5-62

TRADE GOSSIP

Halifax.—The strike at the Halifax shipyards shows no signs of an early settlement. The men were all paid off on leaving work recently, and were requested to remove their tools from the yards. The strike is for higher wages, and it may be prolonged.

Chatham.—A further attempt was made recently to raise a seven-ton propellor, lost overboard some time ago from the car ferry Marquette and Bessemer No. 1, and located by divers on the bottom of the channel connecting Rondeau Bay with the Lake. The attempt was unsuccessful, owing to there being insufficient power, and a derrick will be brought over the spot. The propellor is worth $3,000, and will not be abandoned till a fair trial has been made to recover it.

CATALOGUE ON DIAMONDS

The Joyce-Koebel Co.; Inc., 39 West 32nd St., New York, have published a catalogue on diamond tools as used in the manufacturing industry. A short history of the diamond is given, and the style as used by mechanics is discussed.

Various styles of mounting are also described, and their particular line of feralium holders are given, together with prices and particulars. Tools for truing, grinding wheels, and turning tools for fibre, hard rubber, paper rolls, ivory, brass, bronze, aluminum, etc., etc., are also illustrated. A copy of the catalogue can be obtained by mentioning this notice.

DESIGN OF FLY WHEELS

(Continued from page 551)

In designing split fly wheels, it is common practice to make the joint come half way between two arms. This is most decidedly the wrong place, as the rim being loaded by the centrifugal force, in the same manner as a beam uniformly loaded and supported at each end by the arms, the case is analogous to that of a beam having a joint in the centre of its span.

The split should come through the centre of an arm, the arm itself being half on each side of the joint, and bolted together, to make a complete arm of the same or slightly heavier section as the other arms. The rim is then equally as strong as though it was solid, provided that the bolts in the joint are equal in textile strength to the solid rim, which it is not at all difficult to arrange for under these conditions.

Classified Opportunities

HELP WANTED

WANTED — MAN TO SET UP AND TAKE charge of Gleason straight tooth gear cutters. Must be able to handle men. Salary commensurate with ability and experience. Apply Employment Manager, McKinnon Industries ,Ltd., St. Catharines, Ont. (c26m)

DIE SINKER WANTED—FIRST-CLASS MAN only. Best working conditions and top wages. Apply Employment Manager, McKinnon Industries Limited, St. Catharines, Ont. (c24m)

SALESMAN FOR MACHINE TOOLS SUPplies. Must be a high grade man of engineering knowledge, and good address; for such there are excellent prospects. Address giving full particulars in confidence. Jas. Buckley Co., St. Nicholas Bldg., Montreal. (ctfm)

STEEL WANTED

WANTED—5 TONS OR LESS OF ¼" HEX. steel, also 1 ton or less of 3-16" Hex. steel. This stock may be either hot or cold rolled and the analysis does not matter so long as the stock can be readily drilled and tapped. Skelton Tool Company, Syracuse, N.Y. (c24m)

MACHINERY WANTED

SMALL POWER PRESS SUITABLE FOR trimming light forgings. Apply Wheeler Needle Works, Paris, Ont. (c1m)

ONE END POLISHING LATHE, 30", WITH 12" spindle. Apply Box 686, Canadian Machinery. (c24m)

PATTERNS

TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (ctfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

WHEN WRITING ADVERTISER KINDLY MENTION THIS PAPER

SELECTED LIST

Used Machine Tools for Sale

1—Rockford Horizontal Drilling, Boring and Tapping Machine—Belt driven.
1—Beaman & Smith Double Spindle Boring and Milling Machine.
1—42" Boring Mill.
1—25" Snyder Drill Press—New.
Many other tools at attractive prices.

WANTED

J. & L. Flat Head Geared Turret Lathes. Write us when in the market to buy or sell machinery of all kinds.

CHARLES P. ARCHIBALD & CO.

Machinery and Supplies

285 Beaver Hall Hill MONTREAL

MACHINE WORK WANTED

MACHINE WORK WANTED FOR LATHES, shapers, milling machine and planer, etc. Hourly or contract basis. Prompt delivery. W. H. Sumbling Machinery Co., Toronto. (ctfm)

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is used by the Largest Manufacturers in the Gear Industry. Catalog and Engineering Literature sent to those interested.

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MACHINERY FOR SALE

BARGAIN PRICES

Planer—25" x 25" x 7' Putnam. Good condition.

Oliver Tool Room Lathe—16" x 7'—Q.C.G., taper and relieving attachments with pan—like new.

Punch and Shear—Single-end punch and shear. Copy ¾" through ¾", 15" throat—John Bertram & Sons—like new.

Gap Lathe—24" x 48" x 22' bed—John Bertram & Sons.

Full line of other lathes, including C.M.C., Giddings & Lewis, South Bend, Milwaukee, Barker 18" x 8' beds—condition equal to new.

Morton Draw-cut Shaper—24" heavy duty.

C.M.C.—26" x 12', Q.C. Lathe—like new.

20" x 8' C.M.C.—like new.

Air Compressors—1—8" x 8" Chicago pneumatic; 1—8" x 8" Fairbanks-Morse.

Oil Furnaces—4' x 8' (new).

Drill Press—Speed drill, swing 14".

Bolt Threader—Wells Bros., 1½" capacity.

The above machines are on exhibition in our new showrooms.

307 St. James St., Montreal

Phone Main 2286

Standard Equipment & Tool Works

We Buy Complete Plants Outright

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

563.

CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Vol. XXIII., No. 25 June 17, 1920

A Planning System that *is* a Planning System

The International Harvester Co., Hamilton, Canada, Who Have Perfected This System, Claim that This Department is to Them, What a Service Department is to Any Sales Organization.

—By J. H. Moore

WHAT constitutes a planning system? In other words, when we say that a certain concern conducts a planning department, what do we mean?

As we are about to describe the planning department conducted by the International Harvester Co., Ltd., of Hamilton, Canada, it would be as good policy as any to quote what Mr. Gernandt, the general superintendent of this concern, said was his opinion of this section of his plant: "Our planning departmente is, to this plant, what the service department is, or should be, to any sales organization." Having hit the bull's eye, so to speak, at the first shot, we will proceed into the routine adopted by this portion of the plant.

The duties of the department are varied, so that our best plan will be to start from the time that a new piece (or sample, as it is called) is issued by the experimental department. Readers, no doubt, remember the previous article dealing with the subject of the experimental department and its attendant duties.

On a sample being issued, it is forwarded to the planning department whose duties are to study the piece carefully, deciding on its proper procedure throughout the plant. Readers must not run away with the idea that this decision is arrived at by a select few, for such is not the case. Every departmental head, and executed from the superintendent down, enters into the discussion. Included in the planning staff are four production experts, each a specialist in his own particular line. We will imagine that a new sample has been sent to the planning department, and that the time has arrived to discuss its destiny, so far as its routine of operations are concerned.

Each one interested is notified as to the time set aside for discussion, when at the appointed hour they meet ready for the problem. The part is now studied carefully, and a certain routine of operations adopted. The departments that are best equipped to handle the portion, right from its casting stage, are discussed thoroughly. Care is exercised that the piece makes no undue lengthy trip, but that in as far as possible the series of routine movements are confined to a small area.

The system is now perfected to such an extent that every foreman and departmental head co-operates to the very best of his ability in this regard. Having arrived at a satisfactory decision, the routine of operations are drawn up and o.k'd. This is later arranged in memo form as shown at Fig. I.

This memo contains such information of real value from a systematic standpoint that we shall discuss it item by item.

First, it will be noticed that in the up-

January 14th, 1920.

Routing Memo " 3036
Expl. Memo " 4064

NEW SAMPLE - 1920 DEERING GRAIN BINDER

Mr.
Ass't. Superintendent.

Dear Sir;-

We are turning over to the factory New Sample for:-

AA 540 Reel Bracket (Rep. & W.W.F. A540) W.W.F. means will work for
Grind
Drop
Drift File & Form 21 = malleable finishing dept.
Assemble Cap
Ream (2) 1.378 Holes
" (1) 1.757 "
Drill(2) 1/4" Hole
Drill(1) 17/64" Hole Double
Drill(2) 5/16" " " 11 X = repair dept.
Assemble into special shipping package 26 = Erect Shop No.1

AA 541 Reel Shaft Pinion (Rep. & W.W.F.A. 541)

Grind	
Chip	17 = Grey Iron Fdy.
Drift	31 = Grey Iron Finish Dept.
Turn 1.330"	11 X = Mach. Shop
Assemble	26 Erect No. 1.

Bearing part of above castings has been made 2-1/16" in place of 1-9/16" in accordance with Decision 2514-D.

Sample AA-540 was furnished by Deering Works, AA541 was made here.

Even up and use stock on hand of A540 and A541.

Copy to:
Messrs: Harrington = Production Dept.
Wiggin (2)= Inspection Dept.
McVinnie = Mechanical Dept.
Repair parts =Crowther Honeyford - achine
Stock Basement-Robertson Muldoon - Erect No.1
Order & Schedule - Gallagher Byrne - Gray Iron Fdy.
Cost - Gourley Warner - Grey Iron Finish
Salvage = Craig
Tool = Masterson
Mall.Iron Finish = Linklater
Mall.Fin. = Slater

Yours truly,

PLANNING DEPARTMENT,

BY P.G. Rigby
S.

FIG. 1—MEMO. USED FOR ROUTINE OF OPERATIONS.

per left hand corner is given the routing memo number, also the experimental memo number. This guarantees that both departments will place this memo on file, and in its proper place, ready to find at a moment's notice. Next in importance comes the name of machine on which the sample has to be used.

A description follows, stating that the sample is being turned over to the factory. Its symbol number, routine of operations, etc., are all described. Take for example the item AA 540. We note that this piece has an item stating, to drift, file and form (21). The (21) stands for a department number, in this case the malleable finishing department, which means that the piece goes to this department for the operations stated.

After such information is completed, the changes over the old sample are stated, of course, always providing that the new sample is replacing an old one, as the particular case we have illustrated depicts.

Then follows the information as to who furnished the sample, and if old stock has to be scrapped or used up. In other words, the latter portion of the memo is devoted to details which are of special importance.

A copy of this memo is sent to the various foremen interested, so that it stands as a permanent record regarding the meeting and decision.

Now comes the issuing of what is termed an interior order ticket. This form is shown at Fig. 2, the same style ticket being used throughout the entire plant. The first ticket made out is to the drafting or engineering department. An order is given to prepare such drawings as necessary, after which orders on similar forms are issued to the pattern, foundry and tool departments to make patterns, castings, jigs, fixtures, etc., from these drawings.

Taking it for granted that these elementary steps are thoroughly understood, let us pass on to the card shown at Fig. 3.

This card is known as the routing record card and contains all details of routing mentioned on the memo illustrated at Fig. 1, plus the price of production per 100 pieces. On the reverse side of the card is stated the various machines on which the piece is used. In this way, the planning department have a complete record of each part passing through the plant.

The Duties of the Production Experts

When speaking of the gathering together of the various departmental heads for consultation, we mentioned the presence of four experts in production. Let us consider the value of having these men on the planning staff. When we say that each of these four is an expert in his own particular sphere, we mean this in every sense of the word. For example, one man might be a crackerjack or lathes, but only a commonplace authority on milling machines, while another might be termed a whirlwind on lathe possibilities, but the very opposite on millers, and so on. Boiled down to a fine point the idea of having these experts on the staff is in order to obtain maximum production at the lowest possible cost. Each expert takes a keen interest in his duties as records are kept of their schemes, with attendant successes.

One concrete example, that came to the writer's attention while preparing this article, was a case of a certain product that was previously performed on drill presses. As readers understand, drill press labor is much cheaper than lathe help, and at the start it was felt that the drill press was the proper place to produce the part.

It was found, however, that only four out of one hundred pieces were perfect when drilled, so that immediately different procedure was decided upon. The part was now turned over to the lathe department and, while the labor cost was higher, it was found that only two or three out of every hundred were not perfect in every respect.

Naturally the lathe was decided upon, and while the labor cost was greater, the scrap percentage was so much lower that it wiped out easily the extra labor cost. A planning department, with experts such as described, is absolutely necessary to any plant turning out the enormous number of pieces this firm does every year.

These experts also help to set the piecework prices. This oes not infer that they are time or rate cutters, for the reverse is usually the case. They are the means by which the workman can prove if his rates are too small.

At Fig. 4, we illustrate some actual example of how piecework rates were advanced after proper investigation. The type of form illustrated, and which is only partially shown, is kept in the planning department, thus making certain that an accurate and up-to-date record of rates is kept.

The Control Board System

Let us next proceed to the last step in this system of planning production. A huge board is erected in the planning department, which is filled with small slits, or pockets, similar to the time card boards as used in almost any up-to-date industrial plant. In this board are placed certain production checking cards. Before going into a description of these cards, we will consider the object of the equipment control board system (as it is called).

As stated before, the equipment board consists of a series of visible pockets with cards showing a record of the progress of equipment, and is located in

Works Form 121

INTERIOR ORDER TICKET

Date.............................. 19......

Mr.. Foreman.................................... Dept.

Please do the following work and charge to account, Material.. Labor...

DESCRIPTION OF MATERIAL OR WORK AND FOR WHAT PURPOSE WANTED

Ordered by________________

Quantity and Full Description of Material Furnished	Quantity	Price	Amount

We delivered to-day the above material to ______________________ Dept

______________________ Foreman Date ______________________ 19

FOREMAN DELIVERING WILL FORWARD THIS ORDER TO MAIN OFFICE IMMEDIATELY

FIG. 2—THIS STYLE OF ORDER TICKET IS USED IN ALL DEPARTMENTS.

NAME Reel Bracket
ROUTING 24 x 21 x 11 x 26
REPLACES A 540 REPLACED BY
CAT. NO. AA 540
MATERIAL Mall. Iron.
WILL WORK FOR A540

SAMPLE AND ROUTING MEMO: MEMO NO.	DATE	DECISIONS	DEPT.	x	OPERATIONS	1916	1917	1918	1919	1920	1921
3086	Jan.14.20	2514D	Mall. Fdy. 24		Mold					$9.50	
					Core #1					32½¢	
			Mall. Core		" #2		Per			22¢	
					" #3		100			16½¢	
					" #4		Pieces			3¾¢	
			Mall Fin. 21		Grind					30¢	
					Drop					12¢	
					Drift file + Form					91¢	
			Machine	x	Ream 2.1338					48¢	
					" 1.1757					36¢	
					Drill 2 - 1/4					43¢	
					" 1 - 17/64					30¢	
					" 2 - 5/16					46¢	
					Assemble					$3.40	

FIG. 3—A GOOD EXAMPLE OF ONE SIDE OF A ROUTING RECORD CARD.

the planning department. Certain sections of the board are allotted to the various departments. For example, one portion is labelled "Grey Iron Foundry," another "Machine Shop" another "Tool Room," and so on. Every department in the plant is represented on this board.

The only orders which are not kept track of are standard orders or short orders which will not take more than nine hours to complete.

Suppose we take an actual example of a new sample issued and which has been forwarded to the planning department. As already stated, a meeting and discussion is held, the routing arranged, and interior orders issued to the various departments throughout the plant.

A reasonable limit has been arranged upon by all concerned, regarding the time necessary to complete the jigs, die or fixture drawings for the part. Next comes the setting aside of a certain time limit for the pattern making department to get out the patterns (if any), after which the tool rooms are allowed a stipulated time to produce their finished fixtures, and so on down the line of departments.

In other words, every detail is carefully and thoughtfully planned ahead. The space of time allowed these various departments is fair and reasonable, and is based on former experience. To illustrate the procedure in its entirety, we will suppose ourselves following a sample completely through its journey.

We will take it for granted that we have passed through the discussion stage, and that it has been decided to allow two weeks' time limit for the preparation of necessary drawings. At this stage we had better refer to Fig. 5, which illustrates the production card.

On the card is first marked the catalogue number of the piece, next the name, the machine used on, and the equipment necessary. Now comes the

-Piece Work Price List- Mch. Dpt.-
New prices will take effect on date shown.
May. 5th 1919.

Cat. No.	Operation	Price per 100 New	Old	Reason for Changing
H53	Taper Ream	15¢	12¢	Rate was too low
K518	Ream 1/4" hole	10¢	.07¢	Deeper Hole
K808	Turn 2 11/32" S.O^s.	36¢	30¢	Longer Shoulder
B^a1019	Tap 7/8"	18¢	13¢	Deeper Hole

FIG. 4—THIS SHOWS HOW PIECE WORK RATES ARE WATCHED.

D 4013

Cat. No.
Name
Mch. Used on:
Equipment:-

Order No.	Date
Dept.	
To be Finished	
Sample Rec'd	
Drawing Ord.	
" Finished	
Casting Ord.	
" Finished	
Wood Patt. Ord.	
" " Finished	
Estimated Hours	
Equipment In. Progress 10%	
25%	
50%	
75%	
100%	

REMARKS:

THE PRODUCTION CARD WHICH ENSURES WORK BEING KEPT ON THE MOVE.

order No., the department, etc., etc. Readers cannot do better than follow each item carefully as marked on the card shown. It will be noted that the drawings, patterns, castings from these patterns, and the completed fixtures are supposed to be completed in the tool room one month from the issuing of the order. At the bottom of the card is a section devoted to the progress of the equipment.

As soon as 10 per cent. of the equipment is completed, the date is marked in the proper place. Should the schedule be a little behind, the proper department at once gets a gentle hint to get busy.

Twenty-five and fifty per cent. are likewise marked, but when it comes to 75 per cent., this point is watched with special care. Should the work be behind schedule at this point, a red star seal is stuck on the card in such position as to demand immediate attention. From this point on, which is termed the alarm point, every possible effort is made to speed up the equipment in order to get it out in time. When a red star shows up on a card, everybody concerned knows that this means Rush with a big R.. and that they must all co-operate in getting the material out on schedule time.

As the equipment progresses, the card is moved from one department section to another. Immediately the drawings are completed, the card is marked as completed (in as far as this department is concerned), and passed into the pattern making section. As soon as the patterns are finished, the card is once more filled out, and passed into the foundry department (grey iron or malleable, as the case may be). Immediately the casting is completed, the card is again filled in and passed on to the tool department. This method anyone can tell not only how the equipment is progressing, but in what particular department the part is passing through.

It might be well to mention that these cards stick out two inches from the mouth of the pockets on the board which ensures that they are easily read at a glance.

Should the work be of a special nature, that is, equipment for special attachments, a green seal is placed on the card, which, of course, separates it from the regular line of work. In this way, confusion between special and regular equipment is avoided.

The Tickler System

In conjunction with the board is conducted a tickler system, so arranged that on certain dates, up comes a card reminding you that the equipment for piece No.—so and so—, should be 10 per cent. finished.

At once you go to the equipment board and ascertain what progress the equipment is actually making. Nothing is left to memory, but the system is simplified to such an extent that one has no excuse for error. Periodically these tickler cards turn up at 10 per cent., 25 per cent., 75 per cent. and 100 per cent., so that one is constantly reminded of his duty.

It is only by the adoption of some such system as already described, that a plant of any fair sized proportion can hope to cope with the immense amount of parts and equipment passing yearly through their hands.

Factors in the Heating and Cooling of Steel

There is a Great Deal More in the Problem of Proper Heating and Cooling of Steel than One Would Imagine—Variations of Different Kinds Can Occur, and Herein is Given Certain Factors which Should be Considered*

IT is generally assumed that the proper heat-treatment of large quantities of steel of similar size and shape requires nothing more than a uniformly heated product; that a uniformly heated product requires nothing more than a uniformly heated furnace; that a uniform pyrometer record indicates a uniformly heated furnace and, therefore, a uniformly heated product within that furnace. Nevertheless, variations in metallurgical quality of the finished product frequently occur even with an indicated uniform temperature in the furnace chamber. There is a great deal more in the problem than the maintenance of a uniform temperature in the heating chamber. It may be expected that there would be a material variation in the uniformity of heated product from furnaces of different types, but, as a matter of fact, wide variations quite frequently occur in material heated in the same type of furnace, the pyrometer readings in each case being the same. Such variations are generally brought about by a difference in method of placing material in the chamber and of applying heat to the material so placed. The final test is the uniformity of the heated product, which is determined by the manner in which the individual piece is cooled. The cooling is of great importance, although as a rule little attention is paid to this portion of the process.

While uniform heating is one of the main factors in the heat-treatment of metals, it is the uniformity of the final set or adjustment of the structure in cooling that DETERMINES the uniformity of the actual heat-treatment.

To heat the charge uniformly it is necessary that each piece be subjected to the heat in the same manner, at the same temperature, and for the same length of time. This requires something more than a furnace which will maintain a uniform temperature, without reference to the manner in which the heat at that temperature is applied to the material in the furnace.

If a large quantity of material is piled in a chamber, it is very likely that the outside pieces will be heated to, and cooled from, a higher temperature than the pieces at the centre or at the bottom of the mass. If a large quantity of uniformly heated pieces is plunged into a quenching bath at one time, there is a tendency for the bath to become irregularly heated and for the pieces at the outside of the mass to cool at a different temperature and in a different period of time than those in the centre.

With such mass methods of heating and cooling it is unreasonable to suppose that each piece receives the same amount of heat or is subjected to the same heat-treatment. Notwithstanding the temperature indication, unless all pieces are heated and cooled exactly alike, the indication of uniform temperature, either in the heating or cooling zone, serves merely as evidence but cannot be accepted as proof of a uniformly heated chamber, a uniformly heat-treated product within that chamber, or a uniformly heat-treated product as the final result. There should be a better appreciation of the difference between a pyrometer record indicating an apparent uniformity of temperature in a chamber and of the factors that determine the uniform heating of a piece to that indicated temperature.

A piece of fairly low grade steel, by proper and careful heat-treatment, may be made to meet physical requirements that a higher grade steel, improperly or carelessly heat-treated, would not meet. Of course, no heat-treatment, however good, will ever make the low grade steel as good as the high grade steel can be made.

Doctor Howe, in his book "Iron, Steel and Other Alloys," page 241, states: "You cannot make a bad beefsteak good by the cooking; you can cook it better or worse, and it will be a worse or a less bad beefsteak, but always bad. On the other hand you can easily spoil a good beefsteak by bad cooking. Now, just as cooking is to food so is heat-treatment to steel. Indeed, a pedantic cook might reasonably call cooking heat-treatment."

Doctor Howe's homely simile is very apt and to the point, and it would seem in order to draw a few comparisons between the stove that cooks the steak and the average furnace that heats the steel.

The housewife, unconsciously perhaps,

shows an appreciation of the fundamentals of good heating when she uses a slow fire in baking bread or in cooking a pudding, of which the centre has to be thoroughly done. She cooks a ten-pound roast much longer than a three-pound roast. She realizes that if she fills her oven completely with food, it will prevent the proper circulation of heat. She does not take it for granted, just because the thermometer on the oven door registers a given degree of heat, that her bread or pudding is well done. She makes certain that these are so placed in the oven that the indicated heat is applied uniformly to the bread or pudding.

While the application of heat in a furnace is better than in a cook stove, it is questionable whether the average heat-treater manipulates his dampers as intelligently as the housewife does, or employs the same effort and skill to get a properly heat-treated product.

Many furnaces now in use are not provided with the dampers so essential for controlling the air entering and the gases leaving the furnace. Even when furnaces are euipped with dampers, the dampers are frequently pulled wide open and left so, or sometimes entirely closed, the spent gases being permitted to escape from the heating chamber as best they can, often completely destroying the effect of good heat distribution within the chamber.

Four Factors to be Considered

Consideration of uniformly heat-treated product involves four factors which govern the heating and cooling of all material, whether it be a loaf of bread or an ingot of steel, i. e.: Temperature, Time, Surface and Mass.

(1) TEMPERATURE: The degree

(2) TIME: The period required to saturate the individual piece to the required temperature and to permit the required metallurgical reaction or diffusion and equalization.

(3) SURFACE: The area of the individual piece exposed to the heat—which influences the rate of heat absorption, the time of saturation and the degree of uniformity throughout the piece.

(4) MASS: The unit body to be heated—which influences the time required for saturation, the rate of absorption and the manner of exposure to the heat. Mass should be considered with reference to the individual piece and with reference to a mass composed of a number of individual pieces.

Temperature and Time are the two basic factors. The temperature is determined by the metallurgical requirements. The time period is based primarily on the factors of surface and mass, which may be laid down as a rule to govern the heating or cooling operations. Due regard must be paid to the nature of the material itself. For instance, the time required for the proper saturation of a low carbon steel might vary from the time required for a high-grade alloy steel of identical surface and mass. Generally, in annealing, the time allowed for heating or cooling is too short, particularly with large pieces. From the heating standpoint this statement also holds good in some cases where there are large surfaces in proportion to mass, as in the heating of large circular saws for hardening.

It is desirable to expose to the heat as much of the surface of the individual piece as possible. This holds good whether the operation is one of heating a single piece as a mass or of heating a quantity of individual pieces as a mass. This done, the only other element seriously affecting time is the mass, whether it is the mass of the individual piece or the mass of a quantity of pieces. When heating or cooling a quantity of individual pieces at the same time, it is desirable to avoid the large mass effect in order that there shall be no material variation in the surface area of each individual piece exposed to the heating or cooling atmosphere. In such cases it is desirable to break up the mass in a manner to reduce the depth of material and increase the surface of the material exposed to the heat. This generally reduces the time required and results in more nearly exposing each piece to the same temperature for the same time, instead of subjecting the outside of a dense mass to the heat for a longer time than the pieces at the bottom of the mass.

The ideal cooling condition is approached when the same factors are considered after heating. An illustration of this, from the standpoint of heating, would be to consider the difference in uniformity of a product in the form of small balls or bolts piled in a large mass on the hearth of a stationary furnace, or when passed through an automatic furnace in the form of a thin stream or layer. In cooling there would be a pronounced difference in uniformity resulting from plunging such a mass of heated material into a non-circulating bath and dropping a few pieces at a time into a circulating bath.

The construction and operation of the automobile radiator illustrates the relationship of mass and surface to time and of time to temperature. In the radiator it is necessary to break up the mass and to increase the surface in order to decrease the time of cooling. The same laws control the heating and cooling of steel.

In heating large dies it is desirable that they be thoroughly saturated at a temperature slightly below the final temperature before the formed corners or edges on the face reach the final temperature. As the life of a die is no greater than the life of the corners or edges, it naturally follows that every possible effort should be made to prevent overheating the corners or exposing them to the final temperature any longer than is absolutely necessary. The corners of the piece are the first to heat up and the first to cool off, and it is at these same sections that the evil effects of unequal contraction are manifested. These corners heat and cool more rapidly because the surface in proportion to the mass of these sections is much greater than that of the body of the die, which naturally reflects a difference in time of heating or cooling. With such dies it is most essential to consider the difference in time required to reach a given temperature in heating or cooling, due to the difference in surface and mass of the various sections of the die. Improper heating and cooling, resulting from a disregard of these factors, are responsible for a great deal of the limited service and loss of production, material and labor. Such loss greatly offsets any saving in time or fuel resulting from an attempt to heat the piece quickly without due regard to all the factors involved.

The difference between a small piece and a large one is mainly one of degree, insofar as these points are concerned. The principles hold good in either case. When a quantity of small pieces is heated indifferently, those on the outside of the charge are likely to be affected as the corners of the die, and while, in one case, it is only those outside pieces that are spoiled, in the case of the die the entire piece is ruined. The heat-treatment of a small piece involves no large amount of money and the difference in cost between proper and improper methods is surprisingly slight. The difference in results is all out of proportion to the cost, and it is only good business to bear the slight extra cost in order to produce a superior product, which is cheapest in the long run. In many cases a piece may be properly heat-treated by a suitable method much more cheaply than by an inferior method.

The usual lack of consideration of these points of identical area and time of exposure for saturation accounts for the variations that so often occur in the finished product without any apparent change in the indicated temperature. Notwithstanding how elaborate the pyrometer or temperature recording system may be, good results cannot be secured unless the factors of mass and surface are considered along with the temperature and the time.

The practice of charging and discharging material to or from a furnace without regard to these factors, but with an eye only to the pyrometer, seems to be more of a job of manufacturing pyrometer records than of producing a uniformly heated product. The manner of exposing a piece to the heat is just as important as the manner of indicating the temperature of the heat to which it is exposed. The pyrometer does not necessarily indicate the temperature of the material but merely the temperature of that part of the chamber in which the couple is located. Like the gauge on the steam line, it indicates the existence of heat energy but it does not necessarily indicate the use made of that energy. The indicated temperature must be considered with the element of time and with the influence that the factors of mass and surface have upon the time. The only test worth while to determine these points is the degree of structural uniformity disclosed by the microscope. A laboratory determination of temperature, with a surface exposure or mass effect different from that likely to obtain in the shop, is frequently responsible for material variations in quality disclosed by physical tests, in spite of evidence in the form of pyrometer records to show they should not exist.

Educate the Workman

Proper consideration must be given to the importance of the human element and the necessity for educating those in charge of heating operations to the fact that the heating of metals is an art or trade and that the man in charge of the operation is a sort of metallurgical chef, upon whose skill and judgment depend many subsequent operations and a considerable amount of money.

It is apparent that there is a waste of effort incident to the average heating test, which generally involves nothing more than an investigation of fuel consumption or temperature variation, without regard to the other important points involved in the process of producing properly heated material. Such tests are useless in determining the value of a furnace from the standpoint of heating material. The process of converting the energy in fuel to heat in a furnace is substantially the same as that employed in the operation of an automobile engine. If the average furnace were designed and operated as intelligently as the automobile, there would be much less ground for complaint in reference to waste of time and fuel and misdirected effort. With the automobile, fuel is considered but one factor in the transportation results sought for, and it should be considered in the same light with furnaces for the production of results in the form of heated product. It is the results in transportation that test the automobile, and it should be the results in uniformly heated product that test the furnace.

The trade needs a better appreciation of these points and of the fact that the real goal is the production of quality product at the lowest cost, and that it is invariably cheaper in the long run to do it right than in the haphazard fashion so prevalent at this time. An encouraging feature of the matter is that while heat-treatment should be considered as an art or trade, the principles involved are not complicated or mysterious but subject to appreciation on a common-sense basis of reasoning. If the heat-treating public can be led to an intelligent consideration of these principles, there will be an improvement in methods as well as in quality and cost of operations. Consideration of the highly technical side is a matter to be dealt with by the skilled metallurgists, but after they have determined the method of producing a result there should be good judgment employed in the production of that result on a large scale.

STEEL TREATERS TO HOLD CONVENTION, EXHIBIT, AND SALES MARKET

An event of special importance to the heat treating industry will take place in Philadelphia from September 14 to 18th inclusive, when the American Steel Treaters Society, and the Steel Treating Research Society will hold their second annual convention.

The plans are on a much larger scale than ever before, and will be in the nature of a convention, exhibit, and sales market combined. The commercial museum, where the exhibit will be held, has 80,000 sq. ft. of floor space, and is claimed to have the largest and finest display floor in America. It is interesting to note that this is only the third exhibit of heat-treating appliances and products ever held in the world.

In addition to the various displays and installations, some of the best talent in America will present papers on different heat treatment subjects.

Power will be supplied in the booths, making it possible to demonstrate by actual operation the product or appliance, and other booths will be fitted up with fuel oil, gas and compressed air, in addition to the electrical current. This will be a live convention in more ways than one.

Lines to be Exhibited

All grades of steel, process of heat treatment, hardening department equipment, supplies, laboratory equipment, first aid equipment, inspection bureau equipment, etc., etc.

Following are some of the firms who will display examples of their products:

Bausch & Lomb Optical Co., metallographic equipt., Rochester, N.Y.; Arthur H. Thomas Company, lab. apparatus and reagents, Phila., Pa.; Geo. H. Hagan Co., furnaces, Pittsburgh, Pa.; The Bristol Company, recording instruments, Waterbury, Conn.; Quigley Furnace Spec. Co., furnace specialties, New York; Railway Mech. Engr., publications, Chicago; Metal & Thermit Corp., welding materials, New York; Brown Instrument Co., recording instruments, Philadelphia; American Drop Forger, publications, Pittsburgh.

Bell & Gossett Co., carburizing materials, Chicago, Ill.; Rodman Chemical Co., carburizing compound, Verona, Pa.; Tate-Jones & Co., furnaces, Pittsburgh; Strong, Carlisle & Hammond, furnaces, Cleveland; Steel Treating Equipment Co., carburizing materials, Detroit; Carborundum Company, refractory materials, Niagara Falls; Elec. Furnace Construction Co., electric furnaces, Philadelphia; Driver Harris Company, nichrome, Harrison, N.J.

Mahr Mfg. Co., furnaces, Minneapolis; Scientific Materials Co., laboratory apparatus, Pittsburgh; W. S. Rockwell Co., furnaces, New York; Leeds & Northrup Co., recording instruments and electric furnaces, Philadelphia; Halcomb Steel Company, steels, Syracuse, N.Y.; Simonds Mfg. Co., steels, Lockport, N.Y.; Roessler & Hasslacher Chem. Co., chemicals, New York; Wm. Ganschow Company, gears, Chicago, Ill.; Wilson Maeulen Co., recording instruments, New York; American Metallurgical Corp., electric heat treating apparatus, Philadelphia.

Modern Equipment Co., electric tempering furnaces, Taunton, Mass.; Hoskins Mfg. Co., recording instruments and electric furnaces, Detroit, Mich.; Vanadium Alloys Steel Co., steels, Latrobe, Pa.; Wayne Oil Tank & Pump Co., furnaces, Fort Wayne, Ind.; Pyromagnetic Instrument Co., Magnetic instruments, Chicago, Ill.; The Macleod Co., sand blast equipment, Cincinnati, O.; Midvale Steel & Ord. Co., steels, Philadelphia; B. M. Jones & Co., steels, New York; American Gas Furnace Co., furnaces, New York; The Widney Test Laboratories, modulimeters, Chicago; Industrial Press, publications, New York; Ludlum Steel Co., steels, Watervliet, N.Y.

Dearborn Chemical Co., oils, Chicago; Horace T. Potts Co., steels, Philadelphia; Crucible Steel Co. of America, steels, Pittsburgh; Tinius Olsen Testing Machine Co., testing machines, Philadelphia; McGraw Hill Publishing Co., publications, New York; Advance Furnace & Engr. Co., furnaces, Springfield, Mass.; Wheelock, Lovejoy & Co., Inc., steels, Cambridge, Mass.; The Buda Company, industrial trucks, Harvey, Ill.; Hardite Metals, Inc., alloy carbur. boxes, New York; The Penton Publishing Co. (Iron Trade Review), publications, Cleveland; The Iron Age, publications, New York; Surface Combustion Co., furnaces, New York.

OF INTEREST TO SHIPPERS

Shippers in manufacturing plants will no doubt be interested to know that on and after July 1 the American Railway Express Co. will keep a duplicate copy of every receipt it issues when receiving business from shippers. The duplicates will be retained by the express company for the purposes of record and reference and will be held at their shipping office.

Shippers who have been accustomed to prepare their own receipts or who have their own forms are requested to make provision for supplying duplicates of such receipts to the express driver or receiving clerk who signs them. As a matter of convenience the regular receipt forms of the express carrier will be revised to permit their use in duplicate form.

In cases where prepaid receipts are now being issued in duplicate the extra copy being used as a record of charges paid, a third copy will be required under the new system, and in such instances prepaid receipts will be issued in triplicate. One of the objects of the new system is to bring about better protection for and methods of recording the movement of express packages in traansit.

Tight-Fitting Threads for Bolts and Nuts

A Thread that Will Not Loosen—Is There Such a Thread? Read This Interesting Paper as Presented at the Spring Meeting of the American Society of Mechanical Engineers.

By CHESTER B. LORD

WHAT is the cause of our periodic dissatisfaction with threads when in general they are so satisfactory? What other machine element is so easily made or is so satisfactory as regards strength? Why are there so many different kinds of threads when all are equally satisfactory, or rather unsatisfactory? Furthermore, is the dissatisfaction founded on performance or merely upon theory? Also, is the form or angle of thread a matter of importance or merely an excuse for mathematical gymnastics? The only answer the writer has been able to elicit in reply to these various questions is that we are looking for a better thread; which statement, however, is rather indefinite and usually simply means a thread that will pass the gage. Of course, the real object of the search has been to find a thread that will not loosen.

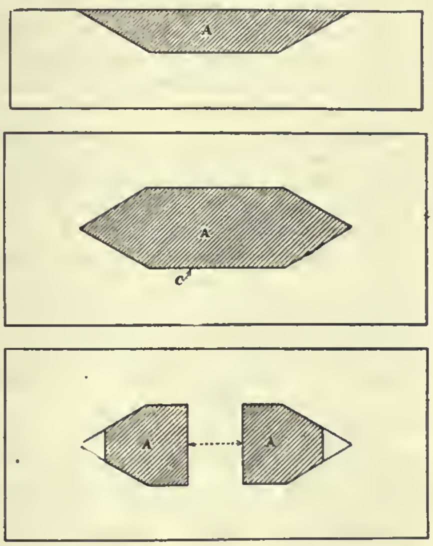
In the past we have attributed our troubles to the fact that our fits were not close enough—the engineer's alibi for a poor design. But fundamentals cannot be violated in mechanics any more than elsewhere in nature, and we are attempting to violate two by insisting upon our present methods of inspection: (a) that interchangeable manufacture is a matter of percentage which depends upon tolerance and cost; and (b) that a force fit is not possible between two parts the surfaces of which are complements one of the other.

Having in mind the first fundamental, it is obvious that the chances of securing a perfect fit are limited by the cost, and the second fundamental would seem to render this entirely hopeless. It is therefore proper to conclude that a good fit is usually due to error, and that if changing both male and female threads produces no relative change, changing one thread must of necessity do so. It is the object of this paper to demonstrate that by making this latter change threads can be produced that are interchangeable practically regardless of tolerance, that will not loosen, and are cheaper to manufacture.

A physician always diagnoses a case before prescribing, so let us do likewise. The loosening of a thread fit is caused by vibration or repeated shock, the chief result of which is to flatten and burnish the parts of the thread that are in contact. This produces a slight looseness and the nut tends to follow the thread incline until it again fits. The same performance is repeated until finally the nut reaches an obstacle too large to flatten, or else the bolt and nut vibrate in unison and there is no further relative movement. This same phenomenon occurs in the case of a bolt screwed in a tapped hole.

Experiments with spring lock washers having a projection that will not allow the nut to turn without cutting the metal, and the same type of washer made without holding projections, show very little difference in their holding power; and this would seem to indicate that their function is to prevent vibration. But we also find nuts without lock washers in places where there is vibration, and still they do not loosen. The answer is that they are individually fitted.

The writer can remember in his shop days picking out and numbering nuts and bolts, and every mechanic knows that he cannot take the bolts out of a cylinder head on an engine of good make and put



FIGS 1 TO 3—SHOWING APPLICATION OF PRESSURE IN THREAD FITS.

them back again indiscriminately. They must go back into the holes from whence they came. All have demonstrated to their satisfaction the fact that a tight thread will not loosen by vibration, and that one with tolerance will, unless it is prevented from loosening by a lock washer or its action limited by some type of nut lock. We cannot lessen our tolerance because the tap wears small and the die wears large, and the lesser cannot contain the greater.

The Problem to be Solved

To gain a better conception of the problem to be solved, consider a board cut as shown in Fig. 1. We cannot obtain a forced fit between the two pieces because one surface is the complement of the other. If we apply a force to A, we are no better off because the pieces cease to fit the instant the pressure is released. We may therefore state as a rule that where two surfaces are complementary to one another a tight fit cannot result without some means of maintaining pressure. But if we cut the board as shown in Fig. 2, theoretically removing no material, we can replace A without force, and any pressure exerted will not make a tight fit unless we distort A or drive a wedge at C. This is analogous to a perfect thread, and driving the wedge at C is equivalent to introducing a slight difference in lead. If, now, we cut off the ends of A as shown in Fig. 3, and apply a force in the direction shown, we can obtain a forced fit because only the angles are complements and because we have a method of maintaining pressure. We can also even distort A because we have room for it to expand. We have only then to provide for three things: a method of making the parts in contact absolutely complementary; the introduction of sufficient metal; and a method of maintaining pressure. With our present type of thread we can only meet one of these—namely, that of partly maintaining pressure. This is demonstrated in Fig. 4, which shows in an exaggerated manner the effect of off lead.

To secure a good fit it is necessary to exert pressure on all flanks of thread, and not on only two as we do with standard thread. Practice demonstrates that the nut and bolt must be held by internal pressure on all flanks, and that the force maintained by screwing the face of the nut against another surface does not prevent loosening; but the writer again affirms that for practical purposes an off-lead thread is better than a perfect one, because in our present practice it is the lead or burrs that usually determine the fit.

While two slightly varying leads make a better fit, both as regards gaging and in actual use, this practice is not to be commended. Using a different lead to secure a fit is doing imperfectly on one side of the thread what the different-angle method does perfectly on both sides, because by having the leads identical and the thread supported on both sides, we secure a uniform finish instead of a distortion. Where the leads are different, the amount of distortion necessary to secure a fit increases with each thread. Thus, if the lead of a 20-thread stud is 0.05 in. and we make it 0.052 in., it will be 0.002 in. off centre on the second thread and 0.018 in. on the tenth thread. This is entirely possible, and superior to a so-called perfect thread as regards fit, but a distortion, unmechanical, and unnecessary.

This is what is done with railroad fish-plate bolts where the specifications

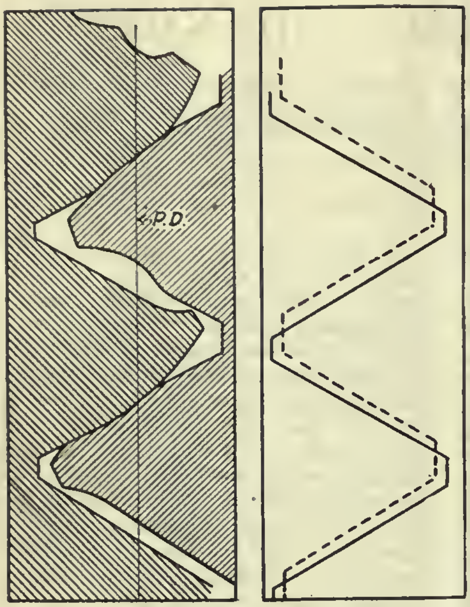


FIG. 4—THE EFFECT OF LEAD, GREATLY EXAGGERATED.

state the minimum foot-pounds at which the nut and bolt may be assembled. The impossibility of meeting these requirements in quantity production is recognized by purchasing agents and most engineers; and so the lead is slightly changed. This, however, is merely a subterfuge and really defeats the purpose of the specifications in that it permits of a poorer and weaker thread than would otherwise be possible.

We are thus confronted with this problem: Without sacrifice of strength, without increase of rejection, without additional manufacturing costs, find a method whereby a male and female thread of the same lead and pitch diameter may be made after repeated loosenings to fit tight without the aid of a locking device. This, according to specifications, calls for a full thread at contact points, pressure applied continuously on all flanks, and maximum strength at the pitch line. This means the addition of surplus metal to the male (which is the only one affected) sufficient to fill out the female threads, which would be an impossibility were it not for the ductility and elasticity of steel. If we add this surplus metal we will find that we can more than fulfil the required conditions by changing the angle of the male thread to a lesser one than that of the female, having the two intersect on the pitch line.

Theoretically, this means a smaller amount of material below the pitch line of the male, compensated for by an increased amount above the pitch line. Actually it means more, because we do not have to recognize as great a tolerance below the pitch line because of our lesser angle, nor above the pitch line because we can take care of a reasonable surplus and the question of initial fit need not be considered. The space below the pitch line in the male, due to difference of angle, is not as great as the tolerance usually allowed.

Every nut is bell-mouthed, and every bolt, whether cut or rolled, is tapered. This is fundamental and cannot be avoided. This being so, we have no trouble in entering, for one or two threads, a bolt of larger angular but less total displacement than the female. It is also true in practice that the first threads of either nut or bolt are weaker than the rest, because they lack support on one side and hence flow easily.

When a male thread of this type and a standard mate are screwed together, we will have transformed a male of lesser angle to one of larger angle or of wider base than the standard U. S. thread, because we have filled out the female thread tolerance as well as that of the male. We will also have uniform pressure on all flanks; the maximum possible material at the pitch line; a hard, smooth surface analogous to a case-hardened one; a fit that will remain snug despite repeated removals and that may be screwed together by ordinary means; and yet we still retain an interchangeable bolt and nut according to U. S. standards. The nut has not been changed or distorted in any way, but has simply served as a finishing roll.

The writer has stated in a previous article that, aside from threads, nowhere else in machine work do we expect micrometer limits on a roughing cut; and the question naturally arises whether an operation similar to that described would not be an effective finishing and sizing operation for commercial work. This would be the equivalent of making them fit the gage, and would greatly reduce the cost due to rejections. We would, of course, still have variable nuts and the necessity of sizing them.

Reasons for Departing From Accepted Practice

Let us now see what authority and precedent we have for making so radical a departure from accepted practice. To do so, let us consider how threads are made, especially by rolling. Generally speaking, thread rolling is circular knurling, knurling being that process whereby the diameter of a part is increased at certain points by a corresponding reduction of diameter at other points, due to pressure alone. It is applicable to both flat and round surfaces, but for the purpose of this article we will consider only round surfaces.

In turning screws and bolts to size the diameter is held, generally speaking, to the pitch diameter. The displacement of metal from the root and lower flank forms the addendum under the process. Cutting a thread on a bolt with a die is a somewhat analogous operation, the similarity increasing as the die becomes duller. For a die-cut 1 in. bolt it will generally be found that with a diameter of 0.990 in. a fuller thread may be secured than with one of 1.000 in., the explanation being that with the die we secure a combined cutting and rolling operation. Due to lack of clearance, if the diameter is too large, part of the metal is pressed into the bottom of the die and with such force that it drags and is torn off, thus leaving a thread of smaller outside diameter than would have been otherwise secured. This same phenomenon occurs when a nut is too tight.

If we require a holding fit on a shaft, do we use tolerances that allow of the shaft being several thousandths smaller than the hole it is to fit? Quite the contrary. We not only specify the fit but also the minimum pressure allowable to assemble the two parts, and we do this both for single units and for quantity production. We might term a shaft and rotor spider a nut and bolt with microscopic threads and assembled with a right-angled instead of a helical motion. Why not fit our bolts the same way, making our tolerances plus instead of minus and using force fit we can depend upon when it means no change in the tools necessary for assembly?

If we look at a finished commercial thread through a microscope, it will be seen that the edge is serrated and that slivers stand up all over its surface. By running a nut over it once we but slightly change its appearance, but by repeatedly doing so—always using a tight nut—we may finally burnish the thread so that it will not thereafter change its size and will have a surface somewhat comparable to a case-hardened one.

The writer has stated that the different-angle thread was practically independent of tolerance. This is self-evident on the finishing operation. Let us now see how true it is as regards the roughing operation. Excluding the ideal condition, there are six variables that may be met with, and these are caused by large and small angle on both male and female. A diagrammatic sketch will show that of six possible variations due to angle alone, the different-angle thread is usable on four, and the U. S. thread only two. Any multiplication of these errors of angle by maximum or minimum tolerance would obviously still further favor the different-angle thread.

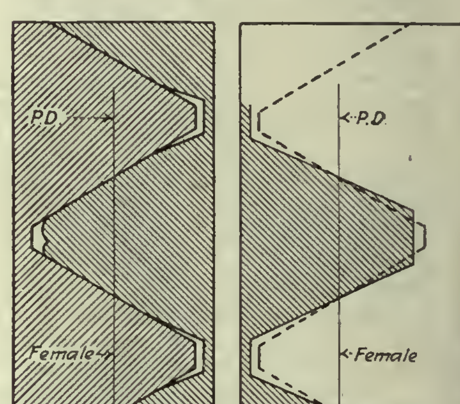


FIG. 5—DIFFERENT ANGLE THREADS, GREATLY EXAGGERATED.

Fig. 5 shows diagrammatically the different-angle thread with the angles of the male greatly exaggerated to demonstrate the principle. We are complying in this case with all the conditions we have just been discussing: we are making the lesser contain the greater, angularly speaking; we are applying force from both directions, at right angles to the axis of the bolt; we have made the angles complementary—not merely two equal angles; we are securing the maximum strength at and near the pitch line, and transforming a thread with a lesser angle than that of the standard made to one with a larger angle, thus filling out the space perfectly and so doing away largely with vibration; and we are securing, whether under pressure or not, contact on all flanks, whereas the standard thread when under pressure secures contact on possibly one-half the flanks, both because it is compressible and because it does not fill the female thread. The only problem to be solved, therefore, was to find an angle of such slope that it could be formed without distortion of the nut or requiring too much force to screw home. To demonstrate this, threads as small as No. 10-32 were used, and as being of possible interest, the writer presents a brief outline of the engineers' report of the experimental work.

Results of Experimental Work

Diagrams of the different threads were fisrt laid out on a 100 to 1 scale so as to determine approximately the most suitable angles to be tested; the Lowenherz thread with an angle of 53 deg. 8 min. being used as a basis. The nut was to have the regular Lowenherz thread with same diameter and pitch as in the 155-mm. shell adapter used by the U. S. Government.

Threads of 44 deg. and 45 deg. for the plugs seemed most favorable and accordingly the following cold-rolled steel plugs were made up, with nuts having the same pitch diameter and lead as the plugs but a thread angle of 53 deg. 8. min.:

1 Angle of thread 44 deg. 54 min., pitch diam. 0.8748, lead 0.0787.

2 Angle of thread 45 deg. 2 min., pitch diam. 0,8748, lead 0.0787.

3 Angle of thread 44 deg. 0 min., pitch diam 0.8748, lead 0.0787.

Test No. 1. Nut No. 1 and plug with thread angle of 44 deg. 54 min. were screwed together without a lubricant. They were started about a half a thread by hand, and then an 8-in. wrench was used for about four threads. The plug was then in so tight that a 10-in. wrench was required to turn it to full depth. After a couple of backward turns the plug stuck so tight that a 20in. wrench would not move it. The nut was then sawed open and removed from the plug and about one-third of a thread of the plug was taken off in a piece of the nut. A magnifying glass showed that the threads in both plug and nut were drawn and cut out of shape where there was a tendency for them to overlap, due apparently to too much metal and no lubricant.

Test No. 2. Nut No. 2 and plug with thread angle of 45 deg. 2 min. were screwed together with a lubricant. They were started by hand for about one-half turn, the an 8-in. wrench was used for five or six threads, and a 10-in. wrench for the remainder. The plug came out slightly easier than going in. After this had been repeated three times the plug could be screwed in by hand. The maximum and minimum plug gage for the nut showed no change in the thread of the nut. Under a magnifying glass it was seen that the metal had flowed to the top of the plug thread from about the pitch diameter outward. The plugs were screwed into the nuts fifty times and there was still what could be termed a "snug fit."

Test No. 7. Plugs were tried out with commercial 1-in. nuts. The thread angle of the plugs was 58 deg., and the pitch diameter 0.9228 in., with one plug this diameter plus 0.001 in., and one minus 0.001 in. This diameter allowed the plug thread in the layout to overlap the entire thread of the nut instead of only half, as in the previous cases. The nuts used were picked out of stock for size with a standard 1-in. thread gage. The smallest plug went into the nut easily by hand. The largest two went together easily with an 8-in. wrench. After being twice screwed together with the wrench, they went together with a snug fit by hand. The magnifying glass showed that the thread from near the pitch diameter outward had been drawn and compressed slightly.

Test No. 9. Plugs of ½-in. diameter with pitch diameters of 0.4684 in. and 0.4699 in. (same as ½-in. S. A. E. nuts) and a thread angle of 50 deg. were tried with commercial ½-in. S. A. E. nuts. The difference in the two pitch diameters made practically no difference in the fits, as they both readily went in with an 8-in. wrench. After they had been screwed together four times, they would go together by hand, but without shake. After they had been screwed together 75 times there was still what could be termed a "snug fit."

Test No. 10. An attempt was made to compare the strength of an S. A. E. standard ½-in. thread with a 50-deg. thread of the same size. The plug with the standard thread on one end and the special thread on the other end was used with standard nuts. A pull of 14,000 lb. was gradually applied and the metal began to give way, which prevented an additional load. During this pull observations were made to determine if there was any "give" in either of the threads, but both remained the same throughout. The nuts were removed and there was no apparent distortion of the threads.

Test No. 12. In this test ¼-20 plugs with pitch diameters of 0.2165 in. and 0.2181 in. with 50-deg. angle were tried out with ¼-in. U. S. standard nuts, one being a commercial nut and the other of a standard aize but made in our toolroom —the tap being 0.250 in. in diameter. Both nuts were tried with a ¼-in. standard plug gage, both being apparently the same size. The nut made in the toolroom was screwed on the maximum plug and went on about one and a half times its length and then stuck and would not go either way. It was finally removed by hammering it on the sides. The threads were rolled and torn from about the pitch diameter outward, but there was not that tendency for the metal to roll upon the outside of the thread as in the previous tests, the outside diameter being only 0.251 in. as against its original 0.250 in.

The commercial nut went on the minimum plug with an extremely tight fit, but it came off very readily with the wrench and left quite a different thread from the previous one. The thread was not torn at all but rolled out ot almost a perfect V-thread with outside diameters of 0.2555 in. as against the original 0.250 in. The outside diameter of the tap for the commercial nut must have been over 0.250 in. to allow this metal to flow out to 0.2555 in. and not jam the nut. If the toolroom tap had been sharper on the flats or its outside diameter greater, there would have been room for the metal in the test plug to flow out to a larger diameter and avoid tearing the thread, and consequent jamming of the nut. Two facts are clearly demonstrated: first, necessity of room for metal to flow; second, one of the limitations of the thread gage.

Test No. 13. Plugs corresponding to standard 10-32 with 50-deg. angle were tried out with standard 10-32 nuts; pitch diameters 0.170 in. and 0.1716 in. They were a trifle too tight a fit to go together by hand, but after being screwed together once with a wrench they went together by hand snugly.

Conclusions

In conclusion it may be stated that the tests would seem to indicate the following:

(a) The cause of stripped threads is lack of room into which the metal can flow.

(b) The pitch diameter should be the same in both threads.

(c) The lead should be the same.

(d) The thread angles should differ by not more than 10 deg.

(e) The limits for the inside diameter of nut need not be adhered to closely, as the inner part of the nut thread exerts very little, if any, holding power.

(f) The outside diameter of plug and pitch diameter of both plug and nut are important and should be adhered to fairly closely.

Molybdenum Steel.—Production rights tor the new Arnold high-speed steel method have been acquired by J. D. Moffat, a director of the Sir Thomas Salter Pyne Company, of Sheffield. The company in question is making preparations for placing the new steel on the market at a lower price than tungsten steel.

John Conley Decides to Become a Machinist

When You Are Sweet Sixteen Anything is Liable to Happen—This Story, which Will be Followed by Later Incidents, Tells the Tale of an Apprentice and His Experiences.

By J. DAVIES

ROBERT CONLEY, superintendent of a large manufacturing concern known as the Queen City Engine Works, was sitting on his verandah one summer evening, when his son, John Conley, age 16, came bounding up the verandah steps three at a time. "Well, dad," he said, "I have done it." "Done what." "Why, got a job at the engine works. I am going to start as an apprentice in the machine shop next Monday morning under old Bill Smith."

"Excuse me," remarked Conley senior, "but I don't know any old Bill Smith machine shop foreman; possibly you mean Mr. Smith." "Oh, well," said the younger, "you know who I mean, it's all the same." "Alright, if it is all the same; in future always refer to him as Mr. Smith. Do not get too familiar with him because you are the son of the superintendent. Did you tell him that you were the son of the superintendent?" "Why sure, that is how I landed the job." "That is mistake number two. If I know anything about Mr. Smith the fact of you being my son didn't help you a particle, in fact it was an hindrance to you, it shows that you were not entirely depending on your own merits, and believe me, son, how you get on with your foreman depends entirely on yourself. Remember this, however, I shall be very glad to give you the benefit of my experience and to listen to your experiences.

"The first advice I would offer to you is to join some evening technical class, where you can acquire a knowledge of machine drawing and construction and workshop mathematics. Although it will be some time before you are called upon to work from a blue print, it is a good plan to begin to learn reading drawings as soon as you enter the shop. Then, when the time comes that you are expected to work from a blue print, you will not have to be continually chasing the foreman around to know what every little thing means. If you think you are a smart boy, don't let the men know that you think so. A certain amount of confidence in your own ability is necessary for your success, but don't let that confidence grow into conceit. You may expect to be fooled a few times by being sent after the left-hand monkey wrench, or some other tool that only exists in the imagination of the man who sent you after it. When you find that you have been the victim of a practical joke, don't get angry. Anger does not improve anything except the arch of a cat's back; take it as a part of your workshop education and you will soon make friends.

"Study in order to become familiar with all ordinary shop tools and their uses. Plan to get some tools of your own as soon as possible, for the youth that is always running around borrowing, and perhaps returning tools, soon gets in disfavor with both men and masters. You do not need an elaborate kit to begin with—a hand hammer, a combination set, comprising square, bevel scale, with square ends graduated on 4 edges; a 6-in. flexible rule, and a pair of inside and outside calipers.

"Combination tools are more likely to be inaccurate than tools made for a single purpose. When buying a combination set, have them tested in the workshop, and if you find them inaccurate to any appreciable degree, the makers will gladly exchange them and thank you for calling their attention to the fact. It is not often that you will have any room for complaint if you buy your tools from some well-known maker, but it gives you more confidence in your work if you know that your tools are correct.

"You will always need a machinist's tool chest, as machinist's tools ought to be handled carefully and not thrown indiscriminately on the top of each other, as is sometimes the case." "Couldn't I make my own tool chest?" "I suppose you could, after a fashion, but it would never give you any lasting satisfaction, and in the end would cost you more than you can buy one for, made especially to suit your purpose.

"Do not take your tool chest into work the first day, get acquainted with the men and the use of the tools, and as soon as you have any use for your tools, then take them in. I remember a young man starting in the shop when I was working at the bench, who came in the first day with a fancy mahogany tool chest, with plush linings, a mirror inside the lid and a very expensive equipment of tools. He didn't know even the name of some of them. Before the week was out the men had borrowed all his tools and invented new uses and new names for some of them, and it was weeks before he really knew the names of his own tools and what they really were intended for. So you see you can go to extremes either way, use your own judgment, be willing to lend, be slow to borrow.

"I guess that is your mother calling us for supper. Be sure and let me know from time to time how you get along."

In this manner Conley, Junior, got started off in his chosen profession. A few days after, his father enquired how he was getting along.

"Well, the first day I was cleaning up and running errands, and Ernest Jackson, that's the shaper hand, asked me to go to the tool crib and get him a side tool, left-hand. I was a bit suspicious about that side tool, but when he said left hand, that settled it. I told him he couldn't pull none of his left-hand monkey shines off on me. I remembered what you had said about the left-hand monkey wrench, so I told him to go and get it himself." "What did he say?" "He said, I suppose you think yourself a wise guy. I said I was too wise to be taken in by any left-hand stunt like that. He told the fellow running the lathe next the shaper and they both had a good laugh, but I didn't see the joke."

"The joke was on you, son. Don't imagine that there are no legitimate left-hand tools. There are left-hand dies, taps, side-cutting tools for lathe, planer and shaper, cutting-off tools, knife tools, threading tools, hobs used on milling machine and gear cutters for making worm wheels. Remember that a left-hand side-tool or knife is bent toward the right and is called left-hand, because it is used for cutting the left-hand side of the work or job that is in hand.

"To distinguish a left-hand tap or thread, take a pencil point, a nail, a piece of wire, or anything that is handy; place the point in the thread somewhere about the centre and move it around the thread clockwise—if your hand travels toward the top, it is right-hand; if towards the bottom, it is left-hand. Make a sketch of a left and right-hand thread and fix it definitely on your memory. If the thread inclines upward from left to right, it is right-hand; if it inclines downward from left to right, it is left-hand. A little study of this will fix it definitely on your memory and you will find it a very useful thing to be able to distinguish right from left at a glance.

"The only exception to this rule is a sectional elevation of a nut or internal thread, such as a thread inside a hand wheel. When an internal thread is shown in section it reverses the angle, because you are looking at the opposite side of the thread to what you are in elevation or outside view.

"Do you understand that son?" "Yes, I think I do, but I will try a little experiment at the shop, attempting to pick out right and left-hand threads for myself, then I'll let you know later how I get along."

The Vanadium Alloys Steel Co., P. O. Box 1250, Pittsburgh, Pa., have issued a very attractive booklet descriptive of Vasco Vanadium Tool Steel. This booklet contains much information of value, also some suggestions concerning heat treatment, etc. Copies may be had upon request."

Construction and Calculation of Gauges

Position Gauges, or in Fact Gauges of Any Description, Require Considerable Degree of Skill in Their Making—This Article, which Appeared in "Engineering," Discusses the Subject Admirably.

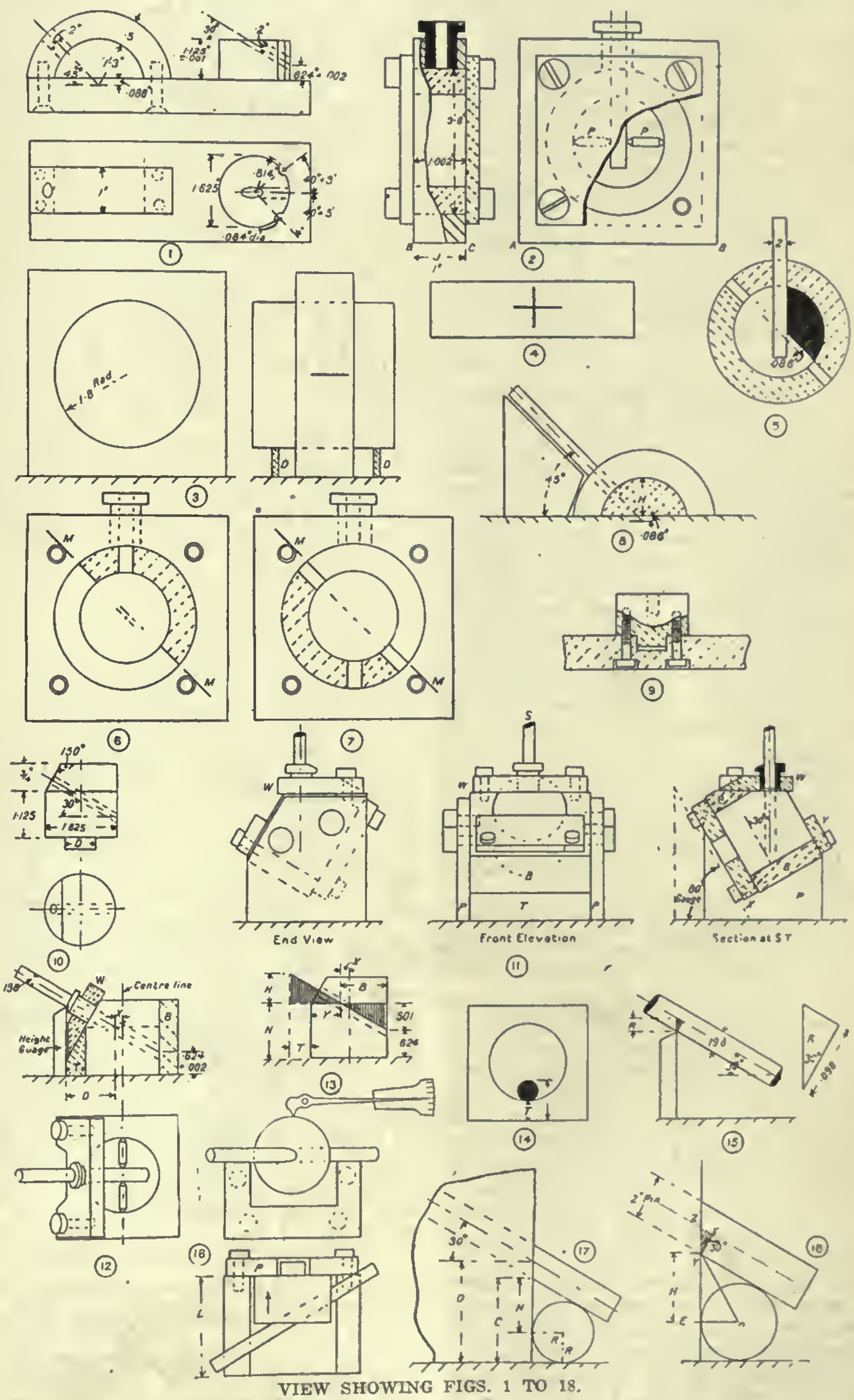
By ARTHUR G. ROBSON

THE production of position gauges usually requires a considerable degree of skill, and the best class of workmanship. Not only is skill necessary to secure a definite measurement, but in obtaining the correct positions of several details, in which the tolerances may be as small as .0003 in., and perhaps not larger than .002 in. It is not always possible to secure a size such that it is the mean of the high and lower limits. Nevertheless, nothing perhaps is more important in precision work than taking advantage of the tolerance. Pins that are called "low" sizes should be made nearly to the "low" limit, whilst holes that are "high" sizes should be about .0002 in. less than the "high" limit. These tolerances give the worker a little "radius" or "freedom" in his manipulative work, and it is to his advantage always to know the tolerances upon work of such an exacting nature.

In Fig. 1 an example of a position gauge is shown. It consists of a circular boss and a curved portion nearly semi-circular mounted on a base. It is evident that although we are left without instructions to the methods of attaching these parts or other means of manufacture, advantage is gained by making them separate and permanently securing them to the base. There will thus be a saving in material and the work will also be less costly.

The boss has a .2 in. hole inclined at 30 deg. to the horizontal, which passes through the boss, intersecting the surface at a height of .624 in. + .002 in. from the base. In the plan, this hole is shown on the horizontal centre line. The only tolerance in this respect is .0003 in., implying that the .2 in. hole must not be more than .0003 in. to one side or the other of the centre line. As a matter of fact, it is here extremely advisable to make the hole central within .0001 in. It is at once evident that any tolerance allowed on the positions of the half holes at the edge of the boss—where 5 min. are allowed on each 40 deg.—is at once reduced if we are compelled to measure from an axis which is not coincident with the geometric axis of the boss. The radial distance of the .084 in. holes is .814 in.—that is, .0015 in. larger than the radius of the boss. In the case of the ring portion of 1.3 in. radius, the centre is .086 in. below the face, and the .2 in. is radial and inclined at 45 deg. The relative positions of the boss and part ring do not matter.

The making of the ring will be dealt with first. A rectangular jig block, marked J in Fig. 2, is required. This block should be of tough steel to withstand usage without becoming indented. It should be ground to 1 in. thick as shown, and the bore must suit the external diameter of the rings, viz., 2 (1.8) = 3.6 in. A short mandril should be made to fit the jig block, to act as a check for grinding the 3.6 in. hole, and as a means of securing the edge or base A B × B C, Figs. 2 and 3, parallel with the axis. Since the top face is fitted with a hardened steel thimble for drilling, it is necessary to have both the base and the axis of the bush or thimble true, otherwise the .2 in. hole in Fig. 1 will not be parallel with the width of the ring. In Fig. 3 the block is arranged as shown until the distances D are



VIEW SHOWING FIGS. 1 TO 18.

equal. The radius of the hole plus the distance D is the height of the axis from the face B C. The scribing block is then set with the aid of a magnifying glass to the height of the axis, and the line is marked as shown. By turning the block over, as in Fig. 4, and striking another centre line, the intersection will give the centre of the hole for the thimble.

The hole in the bush is made .004 in. smaller than .2 in. to give an allowance for finally determining the size and central position of the .2 in. hole. The hole in the bush is central with the ring when the distance piece P—Fig. 2—just fits each side of a pin passed through the bush. By making the ring 1.002 in. thick as compared with 1 in. for the block—Fig. 2—the ring can be securely held in the block by the two plates shown. As shown in Fig. 5, two portions can be made from one ring. In Fig. 6 a ring is shown in the block with the cover plate removed. By making two marks M on the block, corresponding marks may be made opposite M on the ring when one hole is drilled, and by twisting the ring round until the marks on the ring become parallel with M—as in Fig. 7—the second hole in the ring can be drilled. In executing a large order this arrangement is a time-saving one.

To secure the distance .086 in. in Fig. 8, a segment must be made from a ground plug to the height H. This height is equal to $1.3 - .086 = 1.214$ in. If the faces of the cut ring are made level and parallel with the face of the segment, the centre will be .086 in. below the face of the ring. At the same time the faces must be adjusted so that the pin is inclined at 45 deg., as shown in Fig. 8. By making a segment, and then cutting a face at 135 deg., so as just to touch the pin as in Fig. 5, the work will be adjusted better and the desired results more easily obtained. Finally, the securing of the segmental ring to the base is attended to.

The making of the boss will now be dealt with. It is proposed to secure the boss to the base as in Fig. 9 by means of a spigot fitting in a recess and two cheese-headed screws holding the boss down. The finished sizes of the boss are indicated in Fig. 10, as it comes from the grinding machine. The pip D is used to secure the boss in the grinding machine chuck, whilst the boss is made about ¾ in. longer than the finished size to enable a flat surface to be made on it, so that the drill for the inclined hole will have a normal surface to drill on. A portion of the boss is therefore cut to 150 deg. with the end face, until there is left a length of 1.125 in. on one side of the boss. The jig for drilling the inclined hole is shown in Fig. 11. The rectangular block B, in which the boss fits, is held at 60 deg. by means of two side plates P. The bottom plate X merely rests on the base of the block B, but is ground parallel in thickness. The block also has its lower face at right angles to the axis of the hole in which the boss fits. If the bottom plate be set to 60 deg. by a plate gauge applied to it, as shown by the dotted lines, the direction of the hole is obtained. The plate Y is for applying a slight end pressure to the boss. Finally, a plate W fits on the oblique face of the block B. If the mandril is applied in the bush as shown, it should be true by a try square. It is very important that the mandril should be square, for a small amount out of the vertical means a considerably increased amount by the time the hole cuts through to the opposite side of the boss. It is therefore necessary to secure absolute squareness before this stage is left.

As the hole is .2 in., the bush should be .196 in. in diameter of its hole. The .004 in. allowance permits of a little adjustment. It should be observed that there are four conditions that must be fulfilled with respect to this .2 in. hole. There is its size, its inclination of 30 deg., the height of the exit .624 in., and its central position in the boss. As regards the bush being central with the boss, this may be secured as shown in Fig. 12 by use of a pin gauge applied to each side of a rod in the bush.

We have now to find where the plate W in Fig. 12 must be secured so as to guarantee that the height of the exit will be within a few thousandths of an inch of .624 in. If the distance X be found —that is, the position the hole cuts the face of the boss off the centre line—then we can find how high the height gauge must be when at a distance D from the axis of the hole in the face of the boss. Looking at the shaded triangle in Fig. 13, we have:

$B = .501/\tan 30 \text{ deg.} = .501/.5774 = .869$ in.

Hence:

$X = .8694 - 1.625/2 = .0569$ in. and $Y = 1.625 - .8694 = .7556$ in.

The thickness T may be found—as in Fig. 14—by taking the distance from the outside of the block to the surface of a lapped pin, and by deducting the diameter of the pin. If T is found to measure .7325 in., then $Y + T = 1.5881$ in., and the height H is 1.5881 tan 30 deg. $= 1.5881 \times .5774 = .9169$. Therefore H + N or $.9169 + 1.125$ ($= 2.0419$ in.) is the height of the axis of the inclined hole at the distance D in Fig. 12. As the height gauge measures from the under side of the pin in Fig. 15, it will measure 2.0419 less the distance R. This distance R is equal to .098/cos 30 deg., that is $R = .1131$ in. Therefore the height gauge will measure $2.0419 - .1131 = 1.9288$ in. If the gauge just touches the pin in Fig. 12 when the pin is inclined at 30 deg., the height of exit of the pin will be correct.

Appliances will be required for testing the central position of the hole in the boss and the height of its exit. For the central position test a channel-shaped piece of steel of length L—Fig. 16—is provided with a back plate P screwed on to it. The boss is held in the direction of the arrow whilst a pin is inserted in the hole and rested upon the upper faces of the channel pieces, the top and bottom faces of which are ground parallel and at right angles to the face against which the plate P is screwed. By using a surface gauge or universal test indicator capable of reading to thousandths of an inch, the upper surface of the boss is tested, and by turning this surface to the underside any difference in the readings of the gauge will clearly show in which direction the hole has to be "thrown over" by rimering. As a hole is drilled .196 in. diameter the allowance of .004 in. can be utilized to correct its position.

It is evident, however, that the height of the exit of the hole must be tested in conjunction with its central position, and the angle of 30 deg. must also be tried. We therefore require five sets of rimers and pins—a pin and a rimer constituting a set—differing by .001 in. When the hole is drilled the .196 in. rimer is used to clean the hole and then its corresponding pin is tried. Any alteration in the angle, central position, or height of exit is now made whilst the hole is enlarged by .001 in., viz., to .197 in. The success of this operation will depend largely upon the accuracy of the details in the jig, Fig. 11. Even assuming that we have been very exacting in our work, it will be found a little tedious and laborious finally and truly to determine the size and positions of this 2 in. hole.

The next subject to engage our attention is how to test the height of the exit (.624 + .002 in.). In Fig. 17 a pin is shown in the .2 in. hole with a roller just passing under it. This roller is a measure of the height in question. We therefore require to know the size of the roller when the exit is at .624 in., and that of another roller when the exit is on the upper limit .626. If the smaller roller goes under, but the larger one refuses to pass, the height of the exit will be between the prescribed limits. Referring to the triangle X Y Z in Fig. 18, we have

$X\ Y = .1/\cos 30 \text{ deg.} = .1/.866 = .1154.$

$\therefore$ height C (Fig. 17) $= D - Y\ Z = .624 - .1154 = .5086$ in.

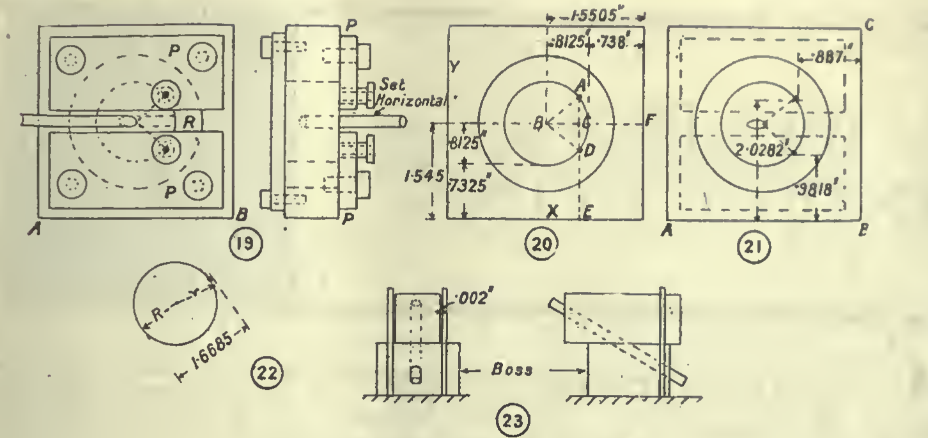
$\therefore H = .5086 - R$ (where R = radius of roller).

Now angle D Y E (Fig. 18) = 30 deg. Therefore $D\ Y = E\ D/\sin 30 \text{ deg.} = R/\frac{1}{2} = 2\ R.$

Further. $H = D\ Y \cos 30 \text{ deg.} = .866 \times 2\ R$. Hence $.5086 - R = .866 \times 2\ R$. $\therefore R = .18616$ in. So that the diameter of roller $.18616 \times 2$ for the low limit is .3723 in. For the high limit roller, $C = .626 - .1154 = .5106$ in. $\therefore .5106 - R = .866 \times 2\ R$, or $R = .18653$. The diameter of the roller for the high limit is thus .373 in.

These rollers should be hardened and ground and have square ends. Although there is only .0007 in. difference between their sizes, it is possible to have the low limit one quite free when the height is near the upper limit.

We have now to consider the partial round holes down the side of the boss. It is necessary to fit a ring over the boss so as to permit the drilling of these



JIGS FOR MAKING POSITION GAUGES.

holes. The jig block B—Fig. 11—could be used for this purpose if originally the hole is made larger than the boss to permit of a ring being inserted. If this method is resorted to there will be a saving of work and material by using one block, but the advantage of having two blocks is that the drilling shown in Fig. 11 and that of the half holes can be proceeded with at the same time by two workers. In Fig. 19 a block is shown with the boss in a ring R. Two plates P are bolted to the vertical face as shown with thimbles fitted for drilling the .084 in. holes. The positions of these holes are shown in the plan Fig. 1, and we must so fix the plates P as to secure these positions. We may drill the holes .08 in. in diameter so as to allow .004 in. for locating finally their positions and squareness. In Fig. 19 the pin in the .2 in. inclined hole must be set horizontal and a good fit in its hole. The faces A B and B C must be at right angles and parallel with the axis of the hole in the block. The true positions of the plates P, with their thimbles, are then determined by obtaining the heights from the faces A B and B C—that is, by knowing their co-ordinate from the axes X and Y in Figs. 20 and 21. The distances .7325 and .738 in. are obtained as shown in Fig. 14, and by adding the radius of the boss to these measurements the heights of the centre lines are obtained as shown from the faces A B and B C.

Now $A\ C = .814 \sin 40 \text{ deg.} = .814 \times .6428 = .5232$ in. Hence $A\ D = .5232 \times 2 = 1.0464$ in. This is the distance between the centres of the holes. Also $B\ C = .814 \cos 40 \text{ deg.} = .814 \times .766 = .6235$ in.

Hence $D\ E = C\ E - C\ D = 1.545 - .5232 = 1.0218$ in.; $A\ E = C\ E + C\ A = 1.545 + .5232 = 2.0682$ in.; and $C\ F = B\ F - B\ C = 1.5505 - .6235 = .927$ in. These distances are measured from the centres of the holes. As the holes in the thimbles are .08 in., we place a .08 pin in them and, measuring from the underside of this size pin, the foregoing distances will be reduced by .04 in., as shown in Fig. 21. Distance pieces must now be made so as to be able to set the plates P correctly.

By very careful working the holes can be so located that the .004 in. allowed on the drilled size is ample for finally determining their positions. It is advisable to make the ring R of the same material as the boss. Various hardnesses of material and the use of slightly too coarse a feed with a drill, the cutting edges of which may be slightly dulled, have to be guarded against. Great care is necessary in drilling the two part holes, for time has already been spent upon the .2 in. holes, and if the small part holes are inaccurately placed then the boss with all the labor employed upon it is wasted. The radial distance .814 in. of the part holes can be tested as shown in Fig. 22, by applying a micrometer across the boss and a pin placed in the hole. The micrometer should read $.814 + .8125 + .042 = 1.6685$ in., as shown. To test the angles of 40 deg. + 5 min. between the holes and the centre line we may use a rectangular piece of steel passing over the .2 in. pin and resting on the face of the boss as shown in Fig. 23. This piece must be made correct for squareness and the two vertical faces must be symmetrical about the hole. Now A C in Fig. 20 was found to be .5232 in. If A C is found when the angle is 40 deg. + 5 min. we shall know the latitude allowed in thousandths of an inch. Suppose also that the radius .814 can be worked to $.814 + .001$. For the upper limit $A\ C = .8141 \sin 40 \text{ deg.} + 5 \text{ min.} = .8141 \times .6441$. $\therefore A\ C = .5244$ in. The tolerance on each side is thus $.5244 - .5232 = .0012$ in.

If the block is made .002 in. less than the inside measurement of the pins on each side as shown in Fig. 23 when the angle is 40 deg., then for the upper limit of 40 deg. + 5 min. the space on each side is $.002 + .0012 = .0032$ in. Therefore in Fig. 23, if the two-thousandth feeler goes in easily in the space shown, while the three-thousandth feeler just refuses to go, then the holes will be situated between 40 deg. and 40 deg. + 5 min.

CUTTING POWER OF LATHE TOOLS

At a recent meeting of the British Institute of Mechanical Engineers the above subject was discussed. In the course of this discussion G. W. Burley, who is quite an authority on the subject, stated there is no practical cutting speed below which it is impossible to obtain a satisfactory surface on plain carbon steels by means of ordinary lathe finishing tools, whether these be made of plain carbon tool steel, ordinary (non-vanadium) high-speed steel, or superior (vanadium) high-speed steel. There is, however, a maximum limiting speed at above which a satisfactory finish cannot be obtained on account of the tendency of the tool to pluck at and tear the surface, this tendency being related to the phenomenon of building up on the cutting edge of the tool. For the finishing of mild steel this limit is not very different for each of the above three varieties of tool steel and is within the range of 48 feet to 58 feet per minute. For the finishing of hard steel this limit does depend somewhat on the variety of tool steel which is employed and is within the ranges of 23 feet to 28 feet, 17 feet to 21 feet, and 28 feet to 34 feet per minute for the three varieties of tool steel respectively.

(2) The durability or life of a lathe finishing tool, whether of plain carbon or high-speed steel, is for all cutting speeds below the limiting speed some function of the reciprocal of the cutting speed; in other words, an increase in the cutting speed below the limiting value is always accompanied by a decrease in the life or durability of the tool.

(3) The most suitable angle of side rake (that is, the angle of side rake associated with maximum durability and cutting power) for a high-speed lathe roughing tool working on steel depends upon the physical properties of the steel. For mild steel turning it lies between 20 deg. and 25 deg., whilst for hard steel turning it is of the order of 10 deg., and if these angles are either increased or reduced there is always a depreciation of cutting power.

(4) The color of the turnings formed by high-speed lathe roughing tool when working on steel is not necessarily a true index of the condition of maximum cutting efficiency. Thus in the case of hard steel turning the turning color, which is associated with maximum cutting efficiency is a pale blue, whilst a mild steel turning which is removed under the conditions of maximum efficiency is practically uncolored, apart, of course, from the natural grey color of the steel.

(5) The net power consumption of a high-speed roughing tool is dependent, other conditions being constant, upon the amount of top rake on the tool, the relation between these two quantities being reciprocal in character, so that, within the limits of ordinary practice, a reduction in the top rake angles of a tool is always accompanied by an increase in the net amount of power consumed. The law connecting the variations of the two quantities appears to be that of the nature of a straight line law for all qualities of steel machined. There are therefore no critical values of the rake angles in regard to power consumption as there are in regard to durability and cutting power.

WELDING AND CUTTING

Lessons on the A.B.C. of Good Welding

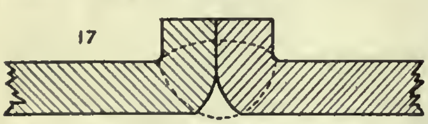
Various Types of Welds Are Discussed in This, the Sixth Chapter

By W. B. PERDUE *

WELDS in mild and steel, which apparently can be executed without special effort or ability, require conscientious effort and painstaking care. It is not difficult to produce a weld of good appearance and with a smooth even surface on the side from which welded. To produce a weld that is strong and will stand up under service is another thing entirely. Automobile frame and crankshaft repairs demand the utmost strength, equal to that of the original metal, because a break in the weld at an inopportune time might be of serious consequence.

Some welders, realizing that they have not secured penetration will smooth over the opposite side of the weld with the torch in an effort to eliminate the telltale edges of the bevel which shows that proper penetration has not been secured, and that the metal has been welded only part way through. The fact that any weld in ordinary steel plate shows the mark of the torch on both sides may, therefore, be taken as conclusive evidence that the welder was willing to admit his own lack of skill.

The increasing application of the acetylene process to manufacture; its marked superiority in all cases where extreme strength is essential; and the demand for operators sufficiently well qualified to produce welds with mechanical properties equal to or identical with the parts welded should awaken a greater interest on the part of those



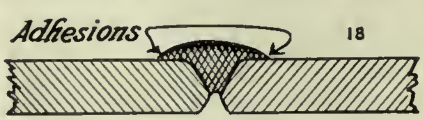
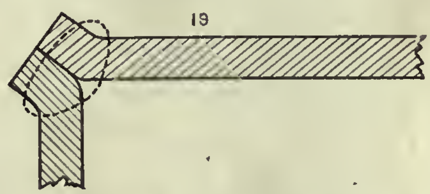


FIG. 17—PREPARATION AND PROPER OUTLINE OF FLANGE WELD. FIG. 18—FLANGE WELD AS COMMONLY EXECUTED.

who are now, in some measure, familiar with the process, but who have not yet taken the trouble to grope beyond its elementary applications.

For the information of the reader, let the statement be made that all these matters can be adequately and fully described in simple language that all can understand, so that with the aid of a pocket dictionary, to explain certain terms applied to metals, which with the layman may be at first unfamiliar, no additional treatises are necessary.



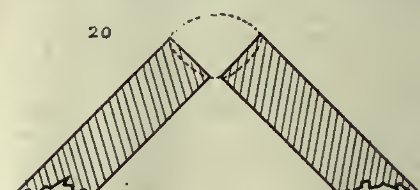


FIG. 19—FLANGED CORNER WELD. FIG. 20—CORNER WELD MADE BY ADDITION OF WELDING ROD.

Careful reading of trade journals, such as apply to his own particular line of industry is of course necessary, and beneficial, since these contain current information for the progressive mechanic not to be found or obtained elsewhere.

Potentialities of the Process

One of the first things to be mastered by the welder is the proper control of the effects of the terrific heat of the welding flame—the hottest flame known to science. When one ponders the fact that metals may be annealed, or made softer; tempered, or made harder; that the grain may be drawn, or made finer; crystallized, or made larger; that the carbon content of the steel may be either increased or diminished, he will realize that he is dealing with potentialities far greater than he at first imagined.

The laws of the process operate whether the person using them is or is not aware of their existence. It is amusing to hear the untrained welder blaming the flux for the fact that he has a weld that is too soft or too hard—generally too hard—the flux intended only as a cleansing agent. Many times the whole blame for a hard weld can be attributed to the fact that the flux was not removed while still warm, if allowed to harden on the surface it—the flux—will be extremely hard and glassy.

Melted Steel

There are perhaps many welders who do not know that melted steel is capable of dissolving 1 and 1-9 per cent. of its volume of oxide or slag in the same form as an alloy in the metal. This happens in every weld made by any process and the only method yet discovered for its elimination is that of the manipulated acetylene ripple weld described in a previous chapter.

There is, of course, no dissolved slag in a forge weld as made by the old-fashioned blacksmith, but the amount of surface slag is considerably more than the small percentage above mentioned. It is also possible to incorporate surface slag in welds made by the electric or acetylene processes, but any good acetylene welder can eliminate practically all slag of any nature whatever.

Manipulation of the metal, to refine the grain and eliminate impurities from the weld, is far more difficult to realize with the electric process, while in addition the oxygen of the air is at all times in direct contact with the heated and molten metal; there being no flame to protect the surface and consume the surrounding oxygen.

As an experienced operator, myself able to use both processes, I feel that I am fully qualified to draw comparisons. Only recently I happened to hear a well-known exponent of the electric process severely condemning the acetylene process. Upon inquiry as to whether or not he was an acetylene operator, he said, "No, and I don't want to be. But as an electric welder I can't be beat." Suffice it is to say that he now knows that at least two acetylene operators can

*Welding Instructor, Heald's Engineering School, San Francisco, Cal.

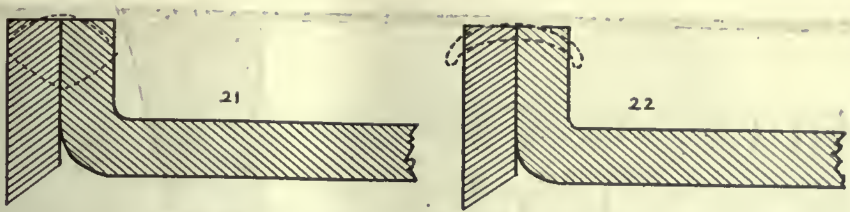


FIG. 21—LIGHT PRESSURE CYLINDER HEAD PROPERLY WELDED. FIG. 22—ORDINARY WELD OF SAME HEAD.

beat him at the electric game, and that he is doing less talking.

Whenever you hear someone loudly condemning either process as "entirely useless" you may take it for granted that he is either ignorant, or that he is trying to get someone to believe something that is not quite true.

In another chapter I have outlined the requirements of a good welding torch. To reduce oxidation to the minimum it is quite important that the gases composing the flame be present in proper proportions and that they be so thoroughly stirred that their contact before reaching the flame is that of molecule to molecule. Thus commingled, and with their flow properly stabilized, complete combustion takes place, the maximum protection is given the weld and the results obtained are dependent entirely upon the ability of the operator.

On heavy work pre-heating should take place both in the path of and behind the welding torch. This tends to eliminate many of the dangers which might otherwise cause changes in the characteristic features of the metal within or near the weld; offsets the terrific internal strains which result from too sudden heating and cooling; and results in a saving, since the actual work of welding is accomplished more rapidly and with less gas.

Heat Treatment

The welder, without personal instruction at the hands of an instructor, well qualified to judge the colors of metals, and to pass by observation upon their approximate carbon content, should not undertake too much in the line of tempering and annealing metals.

If he must depend upon his own resources it is best to go slow and err on the side of caution rather than the side of rashness. This is not because of his lack of mental capacity but, rather, because of the fact that the training of the eye to distinguish the colors of metals is a rather slow process.

It may be said here, that many welders make the sad mistake of trying to temper welds without allowing them to first be heated uniformly in a furnace for that purpose. To attempt to restore the temper in a local section of any steel article with the heat of the weld is utter rashness. Steel shafts and other articles may be hammered while still at a bright cherry red, but the first hammering must be light, and all hammering must cease as soon as the bright redness is lost.

The cooling process must be slow—the slower the better—and no quenching with water should be permitted. It is believed that the use of the proper filler and of sufficient time and patience to secure proper penetration and perfect fusion will remedy most of the troubles encountered along such lines. In the illustrations which follow we have endeavored to show the proper and the common ways of executing certain welds. Examine those you are doing, or those that others have done for you. The comparison with the illustrations will be both instructive and refreshing.

Types of Weld

In addition to the Butt weld previously and fully described, we have another and similar weld called a flange weld, which is often used in very light sheet metal work. Its preparation involves some difficulty except where the edges of the sheets are flanged over by some mechanical means already available in the shop. It is seldom used in thicknesses exceeding 1-16-inch and requires the use of no additional filler since the metal fused from the upturned edges acts as a filling agent. By proper manipulation of the torch the edges can be fused down to a small bead practically flush with the surface of the sheet.

In inspecting a weld of this type one notes most carefully adhesions on the upper surface and that good penetration has been obtained on the reverse side.

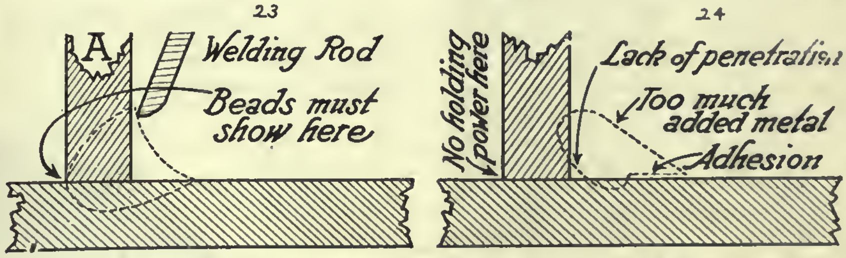


FIG. 23—PROPERLY EXECUTED FILLET WELD. FIG. 24—COMMON TYPE OF FILLET WELD.

The flanged weld is sometimes used as a corner weld by preparation as shown in figure 19, but its use is limited to very thin sheet metal. It is not recommended and preference should be given to the form shown in figure 20, which is made by the addition of welding wire.

In making any form of corner weld, the process of preparation should be given proper consideration. Jigs and clamps must be used to secure proper alignment of the parts, but much valuable time may be saved by securing the proper position of the sheet at some point near the centre, and marking off the locations for tacks, or spot welds, at intervals of from three to five inches in either direction from the centre to the ends.

Having made the tack in the centre, it will often be found that the effect of the heat has been such that one of the locations next thereto on one or the other sides will be in proper position. If so weld it and look at the next mark. This saves a great deal of time over looking around for a new spot to tack, and insures regular spacing of the tacked spots. All tacking should be completed before the actual work of welding is begun.

Welds for cylinder heads as shown page 00) should be bevelled at an angle of about 90 degrees as shown by the bottom of the dotted lines in figure 21. This illustration, however, is intended to show the proper form of weld made without the addition of welding rod by "boring in" with the torch.

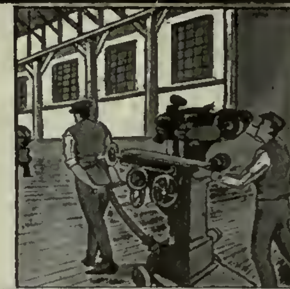
When "boring in" the flame is made a little stronger than is ordinarily used for welding and a shorter stroke is given to the torch. At intervals the torch is twisted smartly away to permit the melted metal to fill up the deep holes that are thus dug out, and occasionally to cool the dip, which becomes quite hot from the striking back upon it of much of the heat from the weld. This additional heating of the tip is also augmented by the position—very near the vertical—in which the torch is held to force the heat of the flame directly downward. It takes considerable practice to execute a satisfactory weld of this type.

With a little experience it will be found possible to bevel work of this nature with the cutting torch. The saving in time and gas over the method of boring in with the welding flame will be considerable. In this way it will be found possible to the more readily manipulate the metal in the weld with the result that a finer grain and greater strength is imparted thereto. The danger of oxidizing or burning the metal in or near the weld when boring in is also eliminated.

To determine the efficiency of welds of this type it is a good plan to prepare a few test pieces of ordinary steel plate of similar thickness to the cylinders to be welded. After welding together the upper edges of these plates they may be tested by splitting open the weld by means of a chisel driven in from the opposite side. A weld that is strong enough to break the plate instead of splitting can be produced, but it is not

(Continued on page 67)

DEVELOPMENTS IN SHOP EQUIPMENT

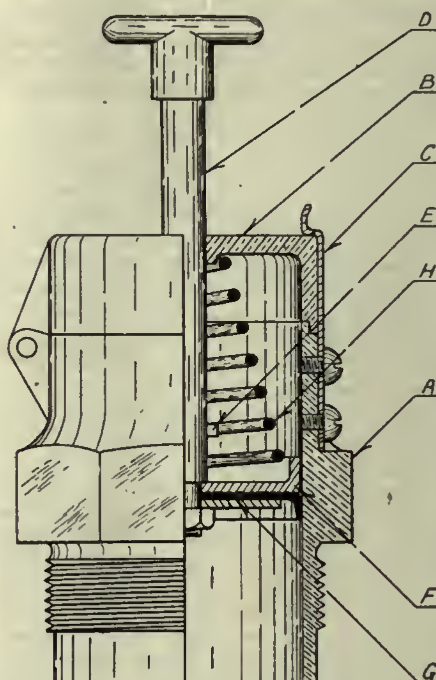


PULPWOOD RECLAIMER

This machine for handling pulpwood blocks from storage is being put on the market by Canadian Reclaimers Limited. As most of the mills store the wood in big piles for winter use and take the blocks from the pile by hand, this machine is claimed to be a decided labor-saver as it drags the wood into a conveyor, thus doing the work of quite a number of men. Taking this into consideration and also the labor situation with regards to the class of men required for this heavy work, the Reclaimer will effect quite a considerable saving in the cost of handling winter wood. The machine is capable of delivering 40 cords per hour into the conveyor. The main principle in the designing of the Reclaimer was to retain the angle of repose of the pile, so that the blocks would come into the conveyor as needed. Accomplishing this, the machine, as shown by the sketch, was designed with a bottom carriage running on a portable track on the ground. Connected to this carriage is a boom lying at approximately the angle of repose of the pile with its upper end resting on the crest of the pile on a small track. The boom, by means of idlers, carries chains which drag down the slope of the pile and pull the blocks into a portable conveyor at the base of the pile. The chains have pointed attachments set at such an angle that they will engage the wood and start it down the pile but do not hold the block after once starting it in motion. The sag in the chains makes it possible to dig a swath from 4 ft. to 8 ft. in depth into the storage pile. After the chains have dug to their capacity, the Reclaimer is moved laterally along the pile and the dragging continued until the full length of the pile has been covered, the boom is then shortened and the machine is moved back along the pile, dragging as it goes.

By thus taking the wood from the face of the pile rather than from the bottom, it means the systematic handling of the blocks. It also eliminates the dangers due to slides, which are a serious problem when the angle of repose of the pile is broken. At pulp and paper mills and also at rossing mills where they have no stackers the Reclaimer can be used for that purpose and, when put in use as a stacker, it is built up as it makes the pile. By the time the wood is all stored in the fall, the machine is in place to be used as a Reclaimer. When used to stack wood it again cuts the cost considerably over some of the present methods of operating.

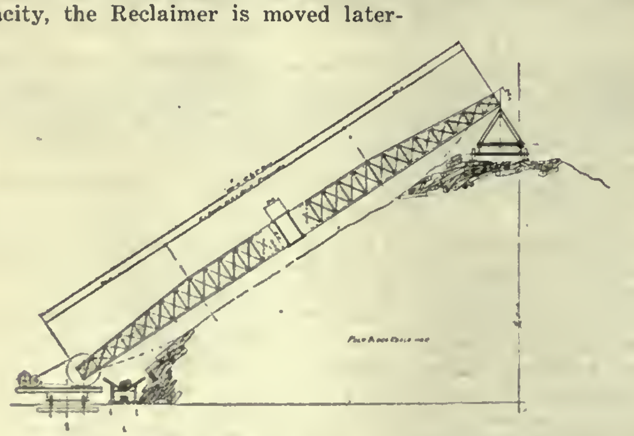
Many pulp and paper engineers have endeavored to design a machine that would handle this wood mechanically, but to date this is said to be the only one that has taken all the factors into consideration and that on trial has proven to be practical.



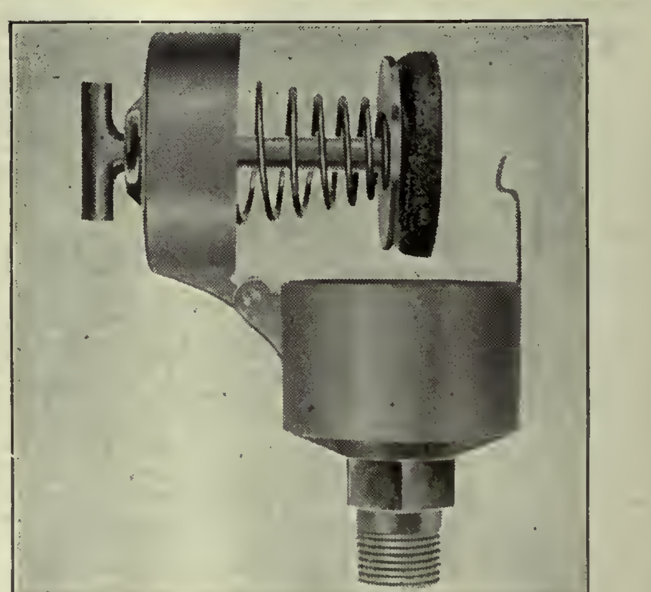
SECTIONAL VIEW THROUGH THE CUP.

AUTOMATIC GREASE CUP

The need of effective lubrication to bearings and all surfaces subjected to friction, has been, and probably always will be, an outstanding factor in engineering problems. The varied conditions under which many mechanisms are required to operate makes it imperative that ample facilities be provided for proper lubrication in order to avoid the in-



DIAGRAMATIC VIEW OF THE PUMP RECLAIMER.



THIS SHOWS CONSTRUCTION OF THE CUP.

convenience and even destruction that frequently follows from insufficient foresight in this connection.

The illustrations depicted show a new design of grease cup which is automatic in its action, for when the cup is once filled and pressure applied, the feeding process is constantly maintained until all the grease has been delivered to the bearing. These grease cups are made in a variety of sizes and designs to suit any desired purpose or condition, the action of the automatic principle being identical in every instance. In Fig. 1 it will be seen that the body A is bored clear through, but the lower portion may be made to any desired shape and threaded to suit.

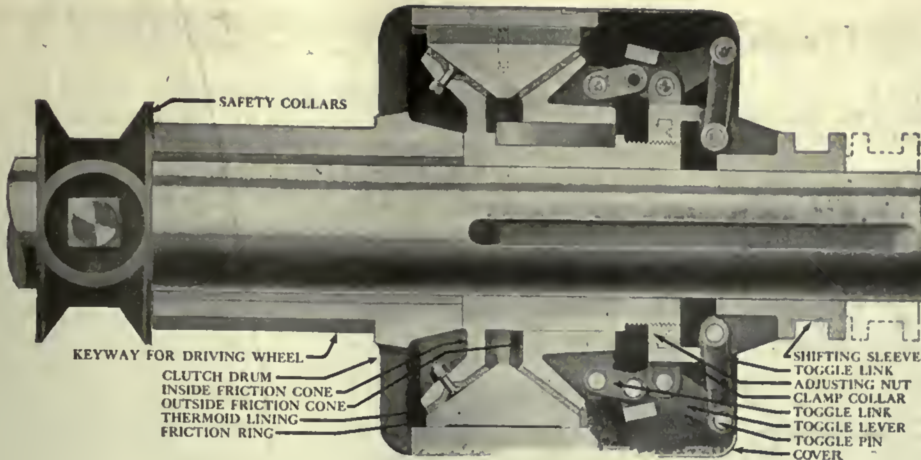
The cover B is hinged to the body, and when closed is locked in position by the steel spring C. When filling the cup the spindle is raised to its extreme position, the small pin passing through a slot in the cover. A slight twist of the spindle locks it in this position and the cover is opened. It will be seen from the construction that the cover can only be swung open when the pressure disc F is retained within the cover. An accurate fit within the cylinder is maintained by the cupped leather washer G. The spiral compression spring H provided a steady pressure upon the grease in the cup so that an automatic feed to the bearing is always assured.

The action of this spring prevents the formation of a vacuum beneath the pressure disc as the latter will follow the grease down as it is gradually delivered to the bearing. Suitable springs are provided for the different grades of grease. All parts are interchangeable on each size of cup so that separate pieces are available for any replacements. The cup may be inverted or located in any position without affecting its efficiency. These cups are adapted to locomotives, marine, gas or stationary engines, and all mechanical equipment where grease cups are used. These cups are made and sold in Canada by the Edward A. Robinson Co., 228 Craig St. W., Montreal.

TWYNCONE FRICTION CLUTCH

The Link-Belt Co., 910 S. Michigan Ave., Chicago, Ill., have placed on the market what is known as their Twycone friction clutch. One of its exclusive features is that it has a one point adjustment. All moving parts are inclosed, making for absolute safety. The clutch is also perfectly balanced, this feature allowing it to run at high speed without causing it to throw in—or out.

The construction is very simple. Moving parts are reduced to a minimum, and high speed does not affect its operation. The clutch has to be eased in when running at any speed, and the friction cones are lined with thermoid. Every part is easily asseccible, and if neseccary can be easily replaced. The accompanying photographs will still further show the construction and appearance of this new style clutch.



SECTIONAL VIEW OF THE CLUTCH.

GENERAL VIEW OF THE CLUTCH.

NEW THINGS IN MACHINE TOOLS

MACHINE VISE

The Hoosier Drilling Machine Company, of Goshen, Ind., are now making a new line of machine vises. The jaws are of hardened steel, but may be modified to meet specific needs.

SINGLE-END DRILLING MACHINE

The Cadillac Tool Company, of Detroit, Mich., are placing on the market a single-end machine similar to the one recently designed for double-end tapping. The spindle feed is operated by a lever above the spindle head. The machine has a capacity of 17/32 inch drilling in steel, and may be provided for either belt or motor drive.

AERIAL GRINDER

The Van Dorn Electric Tool Company, of Cleveland, Ohio, are now building a small aerial grinder, which may be obtained for operating either with d.c. or a.c. installation. The grinder has a 12-inch extension that carries the wheel well out from the frame. Ball bearings are used throughout and grease lubrication is provided.

RE-DESIGNED SHAPER

The re-designed 20-in. crank shaper of the R. A. Kelley Company, Xenia, Ohio, incorporates many improvements over the old design. The machine is constructed for either belt or motor drive. The link connection from the rocker arm is such that the ram is forced on to the bearings, which helps to neutralize the upward thrust of the tool. The apron is so mounted that it may be completely rotated. Table is located by means of a hardened taper plug. Ball bearing thrusts are provided for elevating the screw. A special feed box is fitted to the end of the cross rails, and the amount and the direction of the feed may be controlled without touching any moving part of the machine. Feed is automatically disengaged at the end of the travel. Helical teeth are used on all gears and pinions.

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PRINCIPAL CONTENTS

Signs of Business Safety

AN encouraging sign of the last few weeks has been the greater stability of prices. By that we mean that there has been a noticeable absence of the price-jumping that was so active some months back.

Price stability will do more to hold things in control right now than all the plausible explanations that could be put forward for price increases.

The high prices that are asked for putting up a building now are a big factor in keeping orders from coming into the machine tool market. No doubt the same can be said of other lines.

When a firm is going to put in any considerable amount of new equipment, they are going, in nearly all cases, to build a new house for it. When the price of the house is too high they simply drop all, house, equipment, and all that goes with it.

There are contractors in several lines reporting that they are getting more production now per man per day or hour than they did two months ago. Production is one of the much-needed things in this country, but not at a price that converts a large production into a large loss.

Alberta's Coal Crop

THE taking of the Canadian Manufacturers' Association to the West this year has given the people of Alberta a chance to renew their propaganda for sending their coal East to the exclusion of the tonnage shipped in from the States.

According to figures, Alberta has seventeen per cent. of the coal reserves of the world, and about 80 per cent. of the coal reserves of Canada. Of course, these figures may vary a good deal, but there can be no question that Alberta is one of the greatest coal fields in the world.

Last year Alberta found a market for some 5,150,000 tons of coal, including the home market, while 21,000,000 tons of coal from United States came into Canada.

Coal production has gradually come up from 2,174,329 tons in 1909, until this year they are confident of taking out seven million tons.

There is more or less prejudice to be overcome in the Middle West against burning Alberta coal while there is a chance of securing Pennsylvania anthracite, even at a higher figure.

Alberta's best chance for driving eastward is to make certain that she puts on the market coal that is clean and adaptable for heating during the winter in the Canadian West, where cold is extreme and long-continued.

People in Western Canada are like the people in any other country. They will buy Alberta coal if it suits them and if it pays them to do so. If not, they will buy elsewhere, and all the propaganda under the sun will not make them trade where they don't want to.

Grabbing the Railroads

AGITATORS find little difficulty in showing why the railroads should be taken over by the people. The United States furnished a horrible example of what a bunch of political tinkers can do to railroads.

Congressman W. B. McKinley recently brought out something that should cause confiscators to pause and think. He said:—

"I regret to see expressions by certain classes of newspapers, and also occasionally by a congressman, of a desire to confiscate railroads. There are outstanding in the United States 40,000,000 life insurance policies, policies owned by you and by me for the purpose of protecting our loved ones in case death comes to us. I wonder if these people who so glibly talk of confiscation, or, what is the same thing, cutting off the railroads' power to earn interest, realize that the security back of their insurance policies is in a large part railroad mortgages. About one-fourth of all railroad bonds are owned by savings banks and insurance companies."

There are large numbers of Canadians holding insurance in United States companies, and anything that affects them is of immediate concern on this side of the line.

Culling Out the Weak Spots

SOME idea of the care needed in turning out special steel can be gathered from points brought out in a paper by Mr. De Mare, superintendent of the open hearth department of the Midvale Steel and Ordnance, Philadelphia.

Speaking of the tests made in armor-piercing projectiles, he stated:—

"From each lot of 500 projectiles, four are selected to be fired against a face hardened armor plate at a certain velocity and angle of impact of which two must pass through the plate and remain in effective bursting condition. Should this test be a failure, four more projectiles may be selected and fired, of which three must pass through the plate and remain in effective bursting condition. In the case of 16 in. shells, the cost to the contractor of this second test would amount to about $20,000. Should it fail, the whole lot of 500 projectiles may be condemned or the contractor may be permitted to retreat it and resubmit it as a new lot, which would entail an extra expense of approximately $100,000. It is thus evident that every possible attention must be paid to the quality of this steel, in order to avoid great financial loss, as well as loss in reputation."

There is a point here that could very well be brought out and emphasized, viz., that each piece is good or bad by itself. There is no such thing as an average.

Other lines of industry should get that idea. It would pay and pay handsomely.

A mechanic can work it, so can the foreman—so can the manager or owner.

Each day's work, each day's output can be put up against that simple standard.

Good or bad? Not the average of a week or month.

Perhaps Your Order is Down at the Bottom

Canadians Have Been Wondering for Some Time Just When Their Orders Were Going to Be Filled—The Railway Situation is on the Mend, But a Big Job Faces the Roads.

THOUSANDS OF TONS OF BARS WAITING FOR SHIPMENT

THE photograph here shows how bar iron and steel is being piled at some of the large mills in the steel belt of United States. The space occupied, according to the official furnishing the photo to Canadian Machinery, is not intended for storage, but is right in one of the regular finishing departments.

Speaking of the matter he remarked, "If you or anyone else can come along and tell us how to get this moved, our hat is in the ring for a try at it."

Other pictures show tubes piled, also plates and black sheets.

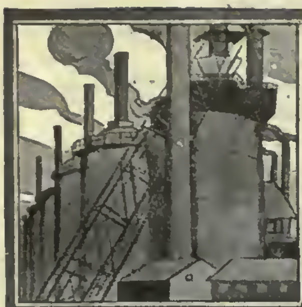
Canadian firms wonder when their shipments are going to get across. Some of your long-looked-for material may be in some of these piles—and dangerously near the bottom, too.

Another U. S. steel man, who was in this district a few days ago, drew attention to the way in which piling was going to throw their shipping schedule out of order. As soon as the roads were unable to keep up with the mill output, material was piled. Shipments that were ready to go out weeks ago were laid down, and others have been put on top in many cases. So it seems likely when the stuff does start to move that "the first shall be last and the last shall be first."

Were all the material now stored around the U. S. mills released it might do much to bring the steel market nearer an even break between supply and demand.

The steel trade has gone through some remarkable right-about-faces since the end of the war. First, there was the period when steel salesmen were right out after trade, in an endeavor to secure a capacity tonnage for the mills. Then followed the export demand, and the domestic trade, waking up, came into competition with it. In a few weeks, a month or so at best, the mills were all booked beyond capacity for some time in advance.

The incessant demand has been kept alive and to the front by the switchmen's strike. Everything has played into the hands of the premium operator. The increased tonnage reported as going through the mills has meant practically nothing to the consuming trade in Canada. Turning it out is one thing, but getting it across is one greater thing at present.



MARKET DEVELOPMENTS

Some Shipments Are Coming Through Now

But the Dealers Are Booked Against Any Steel that Comes In—Machinery Market is Quieter, but Inquiries Nearly Always Turn Into Sales—Scrap Market is Dull.

ALTHOUGH figures given out indicate that the steel mills of United States are producing at a good rate the relief this ought to bring to Canadian industries is largely negatived by the inability of the roads to get the material away from the mills. In the last few days some fairly large shipments have been coming to Toronto, mostly in sheets, plate and bars, although in no line have the receipts been in keeping with the business waiting to be satisfied.

U. S. auto firms have had buyers in the Canadian field looking for much-wanted sections, which are not being produced in any quantity at the mills now. One Michigan firm was able to pick up a nice tonnage in a Toronto warehouse a few days ago. Canadian firms, on the other hand, have their own men in United States to see what they can get from the warehouses or the mills there, but as a rule they are meeting with very scant success.

Machine tool dealers report a rather quiet week, and the same is true of the New York market, where they are looking to the railroads to come in and be the large purchasers of equipment. In the Canadian field the inquiries that do come in are very easily converted into real orders. No large orders are reported, the most of the business being for replacement purposes or small additions to existing plants.

The scrap metal markets in Montreal and Toronto are very quiet. Foundries and melters in general that would, in ordinary times, be taking on scrap, are out of the market, because they cannot get their right supplies of coke, etc.

MONTREAL TRADE REPORTED ON A BETTER BASIS THAN FOR SOME TIME

Special to CANADIAN MACHINERY.

MONTREAL, June 17.—Business activity in and about Montreal continues to be of an encouraging characmter. Some disturbing elements have featured the situation of late, but the general trend is toward steady progress. The port has taken on midsummer interest and operations on the waterfront compare favorably with pre-war days. Additions to trade routes have become extensive this season, so that at the present time connections can be made with almost any country on the globe. The strike among the foundry workers has been terminated and activities in this line are again becoming normal. This will give relief to other industries that have suffered more or less by the shortage of castings. Considerable interest is being displayed by the A. F. of L. convention, which continues throughout the present week.

Slight Improvement Showing

Without committing one's self it is safe to state that the situation this week has shown slight improvement. The gradual relief that has been given to railroad operations in the States has been reflected in the steel shipments to this district, yet, while the change has been very encouraging, some weeks must inevitably elapse before normal transportation can be effected. The present demand continues to be of such a character that any addition to current supply can easily be disposed of to customers whose orders for material have been on the books for months. Dealers are anticipating the possibility of warehouse accumulation before long, provided the present improvement is maintained. The relief that is beginning to show is more in the lines that are in general demand than in odd shapes or sizes, as the large mills are operating for longer periods on this class of commodity; the lines in lesser demand having to wait the accumulation of sufficient tonnage, or be taken to a smaller mill where a higher price will rule. Dealers here state that supplies of tubes are under the demand, and that it is frequently difficult to meet the needs of their customers. Deliveries are uncertain. as the state of transportation offers little assurance of through shipments, as long as two months having elapsed, recently, between shipment from the mill and the receipt of the material at the fabrication point. Sheet requirements continue to be a feature here and dealers are unable to secure sufficient to meet even the most conservative demands. The local quotation is much stronger and dealers are asking as high as $12 for No. 28 black; the nominal price may be given as $11 per hundred lbs. Canada dull plates are quoted at $10—52 sheets to the box. Galvanized sheets are not plentiful and the little that comes in is immediately absorbed by the trade, so that warehouse supplies are next to impossible. Premier sheets are quoted nominally at 12 cents per lb.

Deliveries Show Gradual Improvement

Despite the general quietness of some markets, dealers in machine tools have no complaint to offer as regards the volume of business, but believe that improved delivery would tend to add to the sales of new equipment. Some dealers state that shipments are coming forward better, while others claim that no improvement has developed. One dealer remarked this week, that he has been waiting for a small piece of equipment that was shipped from the American factory by express, on May 20th. Inquiry as to non-arrival brought out the fact that the article has been held up at the border awaiting the regulations that must be carried out in regard to export of goods from the States. Second-hand machinery continues to be placed and considerable of the present business must be credited to sales of used equipment. Small supplies and accessories are in good demand but showing a slight falling off. Prices are generally well maintained.

Dull Scrap Market

Dealers are looking forward to a betterment in old material activity, but present reports do not indicate that any significant developments have taken place to alter the dullness that has marked the situation for the past several weeks. Trading here is quite light and the demand shows little signs of improvement. The bulk of the present business is with local foundries, but even these have been operating below normal, due to the disaffection among the workers. However, a settlement has been arrived at and activities are again being resumed, and a return to better demand for machinery scrap is expected. A little heavier demand has turned up for some of the non-ferrous scraps but not what would appear to be a steady improvement. Brass and copper scraps are quite strong, an advance of ½ cent per lb. being noted on light brass, zinc and lead, the present quotations being 7, 7, and 7½ cents respectively. Steel scraps are very quiet with dealers showing little buying interest.

SOME CAR LOTS COMING ACROSS NOW

But Shipment is Still Indefinite—Machine Tool Market Not Active This Week

TORONTO.—The past week has been quieter in the machine tool market. There are inquiries coming in, though, and these are real honest-to-goodness prospects in most cases. The present level of prices means that a man is going to think seriously before buying, and when he comes into the market he is very likely to buy. Much of the business now is in small orders. In other lines there is a good volume of business moving. There is nothing unusual in the fact that there is a falling off at this time of year, as the market generally experiences the samething at the start of the summer season.

Dealers find that deliveries of orders are still slow and many machines have been on the road for an unreasonable period. For instance, one dealer has a machine that left Jamestown, about 50 miles from Buffalo, on the 27th of April; and as far as this end is concerned, is still on the way here.

Several questions have been asked by United States firms regarding the taking off of the seven-and-half per cent., and the payment of the one per cent. sales tax. Of course, the 7½ per cent. is off and is not now being collected. The sales tax of one per cent. can best be explained by a suppositious case. Take the purchase of a machine worth $1,000. The duty on that would be 27½ per cent., making the price on which the one per cent. would be paid $1,275, or $12.75 tax. That amount would be collected when the machine was cleared at the customs, and the American maker would not have to bother with it at all.

POINTS IN WEEK'S MARKETING NOTES

Shipping conditions are reported better at Montreal, both for import and export business.

New York machine tool market continues to be very quiet. The railroads are counted upon to do heavy buying very shortly.

No very large orders are reported in the Canadian field. Most of the inquiries that come in are readily converted into real business.

Scrap metal markets are very quiet. Old rubber is also at a low market, only 2½ cents per pound being offered for old auto tires.

Pittsburgh reports that steel mills are producing at a high rate, but shipments are stil backward.

Buyers from U. S. auto concerns have been in Canadian centres in the hope of finding certain much-wanted steels in warehouse stocks here.

Shipments of black sheets and plate reached Toronto this week in fair tonnage. Nothing much came through in the way of tubes.

Some traffic reports claim that inside of two months conditions will be normal.

Dealers in small tools report a lot of orders coming in. . There are no very large buyers in the market at the moment, but a lot of different lines are contributing.

According to some reports, there may be changes in prices announced before very long, in the relative selling figures of high speed and carbon tools. It is not likely that there will be anything radical in this, the adjustments being intended to put Canadian makers in better position to meet competition.

The Steel Market

A number of cars came in over the week-end, mostly 10 and 12 black sheets and some plate, one warehouse stating that they had a string of eight ready for unloading. Pressure is being brought to bear continually on the mills to get them to put through certain much needed tonnages. One Canadian mill-man states that under circumstances such as are existing at present the only thing is to go ahead with their own programme, "for no matter which way I turn some one is on my neck," he explained. Mills may have a preference for putting through rounds, and the men in the mills may like that work because the tonnage generally piles up quicker on that work—and all this may please the man selling steel to contractors who use rounds for reinforcing.

All of which is fine, but it does not fit in very long with the programme of the agricultural implement man who wants flats.

Boiler tubes are not arriving. One Toronto house had one order for a car 16 ft. x 3½ in., which were placed with the mills weeks ago, and work on which was finished weeks ago. There has been no chance of moving this material, so U. S. warehouses were resorted to, and a stiff advance paid over mill prices. The Canadian jobber handling the business makes very little on the deal, but he has secured much-needed material for his customer. There is hardly any limit to the tubes that could be sold now were deliveries any better.

It is a common thing now for Canadian firms to have their own men scouring U. S. centres for much needed lines. Some pick up odd lots, but others find, as one superintendent states, "scouring through U.S. stocks that don't exist." This business of looking for material works both ways: A big auto firm in Lansing, Mich., had buyers through here just a few days ago looking for small angles, about ¾ inch. A certain Toronto warehouse had 40 tons and it was a pleased U. S. buyer who came down and carted away the lot. The warehouse replacement price, based on a 100-ton lot of the same material, was $1,000 more than in December.

Scrap Market Dull

One large firm of scrap metal dealers sized it up like this to-day: "You can take the phrase that suits you best —dull, quiet, stagnant or inactive." Any of these will tell you what is going on in our business this week, and we don't see anything in sight that is going to make much difference.

The weakness in the scrap market is due largely to lack of buyers who can't buy scrap, especially steel, cast iron or stove plate, because their supply of coke is uncertain.

The new one per cent. sale tax makes little or no difference in this trade. If material comes from the U. S., the tax is paid at the border.

The yards of some of the smaller dealers are stocked with rubber, especially tires. The prices for these stay very low, not over 2½ cents per pound being offered now. Dealers say the market is full of new rubber and the demand for scrap is not keen.

RAILROADS WILL ENTER THE MARKET

U. S. Machine Tool Trade Look to Them To Be Big Buyers Before Long

Special to CANADIAN MACHINERY.

NEW YORK, June 17. — About the same conditions prevail in the machine-tool trade that have been reported during the last three or four weeks. There is very little enquiry or buying, and such purchases as are being made are single tools or small lots.

It appears quite certain that the major portion of the machine tool business for some months will come from the railroads. Their wants are well known, and as soon as financial or other necessary preliminary arrangements have been made many roads will come into the market for shop equipment. The purchase of $600,000 worth of shop tools by one road, the Atlantic Coast Line, reported last week, shows that the aggregate purchases of the railroads will be tremendous if other roads buy on a comparative scale.

Manufacturers, quite generally are staying out of the market. All metal-working lines are dull and inactive so far as new business is concerned, though there is plenty of business on the books to carry plants along for several months or longer.

IT MAY TAKE FOUR MONTHS TO CLEAR OUT THE BLOCKADE OF STEEL

Special to CANADIAN MACHINERY.

PITTSBURGH, June 17. — There has been an increase of about one-third in steel production to date, from the low point caused by the recent rail strike, the rate being now only a few per cent. under the rate of last March, the highest rate since October, 1918.

The American Iron and Steel Institute reports a production in May of 2,883,164 gross tons of steel ingots, by 30 steel companies which in 1918 made 84.03 per cent. of the entire production of the industry. Using this proportion as a basis, and taking account of the number of working days in the month and year, it appears that production of steel ingots in May by the whole industry was at the rate of about 41,050,000 gross tons a year. The average rate for April had been about 37,550,000 tons, but in the forepart of April the rail strike was only affecting the Chicago district, the other districts proceeding at the high rate they had attained in March, when the industry was making ingots at the rate of about 45,200,000 tons a year. The low point in production fell in the third and fourth weeks of April, and for a short time production was probably under 34,000,000 tons a year. There having been a progressive improvement during the greater part of May, the 41,050,000-ton average for the month suggests that production at the close of the month was at about 43,000,000 tons, and there has been a further increase thus far this month, so that attainment of a 45,000,000-ton rate before the end of this month seems rather probable.

These comparisons have great significance. Since the armistice there have been two scarcities, the first being a scarcity of orders at steel mills, the second a scarcity of steel on the part of consumers. At no time since the armistice has there been anything like full production except in February and March of this year. Full production, therefore, has not been tested out, for two months of full production would not furnish a test, when all buyers had been absolutely bare of stocks. The stocks normally carried by jobbers and manufacturing consumers, for the ordinary and convenient prosecution of their business, amount to several weeks of production. It is probable that the rail strike of April and the great curtailment in deliveries that ensued, found not a few consumers with fair sized stocks, accumulated in the brief space of two months, otherwise the curtailed deliveries of steel would have caused still greater hardships than were apparent. If steel production and deliveries had continued at the March rate, it is quite probable that steel would now be so plentiful. Now the production rate is being restored. It is true that some members of the trade continue to speak of there being barriers to full operation of the steel industry, but it does not seem at all logical to assume barriers to the production of steel and not at the same time take into account that unfavorable conditions would also affect the disposition of people to consume steel. The natural presumption would be that if the steel consumers can function the steel producers can also function. The steel making capacity has increased 50 per cent. since before the war and it is yet to be seen whether the steel demand has also increased 50 per cent.

Traffic Conditions

The major testimony is that rail traffic conditions have experienced a further improvement in the past week, though a few observers claim there is no really definite improvement. The general feeling among the mills is a sanguine one as to the nearby future of transportation. The argument is that while thus far the improvement has been slow, in the number of cars furnished for loading and in the time required to get shipments through, it is always the case with a traffic congestion that the beginning is the difficult thing. Once some little inroads on the jam are made the work of clearing it becomes easier and easier, the effects being cumulative. Thus the more common prediction is that within a very few weeks rail conditions will be normal. That would mean simply that the railroads would be able to furnish the furnaces and mills with full supplies of raw materials, and be able to take away the current production of steel. Even at this time the shipments of steel, though increased, are somewhat under the production. Normal operation of the railroads, however, would not take care of the large accumulation of steel that would be left at mills, for moving that steel would mean the railroads taking an overload. The common prediction, therefore, is that it will be a long time, say two to four months, before all the accumulated steel at mills is cleared off. Even with an ample car supply, it takes time and labor to pick up the steel and load it, while furthermore it must be remembered that some of the accumulated steel is in billet, sheet bar and ingot form and requires further rolling. A stock of ingots can be worked off only gradually, by the blooming mill working a few per cent. above normal.

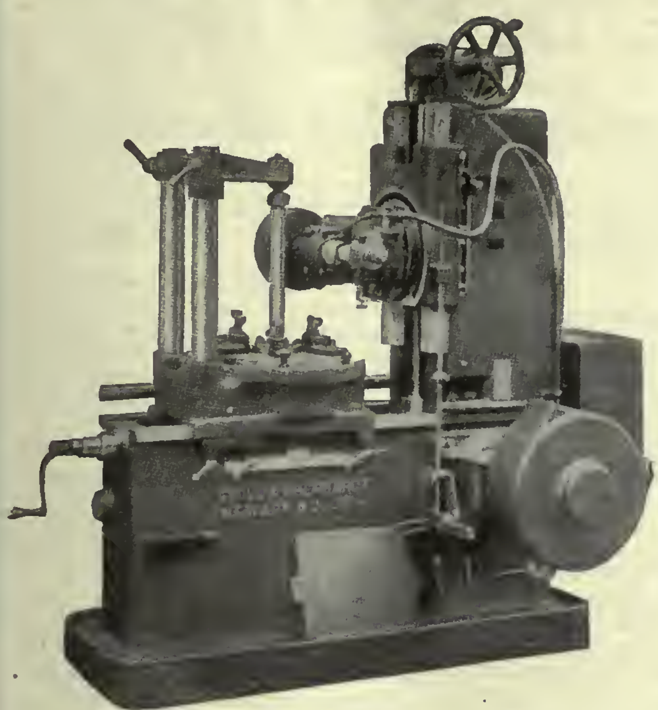
Steel Corporation Tonnages

The Steel Corporation continues its remarkable sales record, the unfilled obligations having increased during May by 580,719 tons, bringing the total June 1 to 10 940,466 tons. This is equal to the tonnage that would be produced in 8.2 months, working at full rated capacity of 52,500 tons per working day, or nine months, working at 90 per cent. of capacity. A few months ago, when the independents were advancing their prices and hoping the Steel Corporation would do the same, the claim was made that the corporation could not continue its adherence to lower prices, as it would soon become hopelessly oversold and its customers would be unwilling to buy for the late deliveries which alone the corporation could offer. A test showing the incorrectness of this reasoning was furnished in May. The independents, sold up in few cases for as much as four or five months, had a dull market, while the Steel Corporation, sold up for an average of eight or nine months, had an active market. The case was simply that buyers expected the independent prices to come down eventually to the Steel Corporation level, hence would not commit themselves any distance ahead, while they had great confidence in the Steel Corporation prices and would place with the corporation all the tonnage that would be accepted. The increase in unfilled tonnage in May, 580,719 tons, was equal to 44 per cent. of the corporation's capacity for the month, and estimating the shipments at 68 per cent., production having been perhaps 85 per cent., the bookings appear to have been about 112 per cent., or 12 per cent. over capacity and 65 per cent. or so over shipments.

The steel market is quiet, but is plainly carrying out the program one would expect. The mills previously getting the highest prices, because able to make prompt shipment on account of having but little business on books, have had to come down in prices. The mills sold up for several months have not had occasion to do so, and presumably will maintain their prices as long as they have unfilled orders on books at those prices.

Pig iron is dull and unchanged.

D. M. McLean, of the Canadian Ingersoll-Rand Company, Sherbrooke, Que., is again back in his office after a period of several weeks in a Montreal hospital, where he underwent an operation.



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For Gears up to 120" dia.

Catalog describing full line of Gear Cutting, Hobbing and Rack-cutting machines on request.

Write for prices and deliveries

The A. R. Williams Machinery Company, Limited

ST. JOHN, N.B.
WINNIPEG, VANCOUVER

If It's Machinery---Write "Williams"

64 Front Street West
TORONTO

Gray Iron and Semi Steel Castings of all Descriptions

From 5 lbs. up to 4 tons

Foundry capacity, 15 tons per day.

Difficult castings our specialty.

Mixtures regulated by chemical analysis and all castings sandblasted.

Estimates from blue prints submitted promptly.

If desired, we can make patterns to your drawings.

G. W. MacFarlane Engineering, Limited

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P.H. or Imperial Files

"They cut faster and wear longer."

Be File-Wise

Ingersoll File Company, Limited

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INGERSOLL

ASKING FOR BONUS ON SHIP BUILDING

Several Interests at Ottawa to Present Case for the Yards of Canada

Ottawa.—A delegation of about forty representatives of the Maritime Provinces, Quebec, Ontario and Pacific coast shipping interests was introduced to Premier Borden and members of his Cabinet by H. Stevens of Centre Vancouver, and urged that either of two forms of assistance to shipbuilding be extended by the Government. The first form of assistance asked was the granting of a subsidy of $10 per ton of displacement and $10 per indicated horsepower. The second suggestion was that the Government should assist in the financing of foreign contracts.

The Prime Minister promised that the representations of the deputation would be accorded most careful consideration.

It is understood that a very large foreign shipbuilding contract has actually been offered, provided that the Government will assist in financing it during the present adverse conditions of exchange. It is stated that the foreign interests affected are willing to put up a very large proportion of the cost, but that they desire that the Government make some advances in the circumstances. The proposal is believed to be before the Cabinet.

St. John, N. B.—At the annual meeting of the shareholders and directors of the St. John Drydock & Shipbuilding Company, James Playfair, of Midland, Ont., was elected president; D. S. Pratt, of Midland, vice-president and managing director, and Col. Thomas A. Duff, of Toronto, secretary. Other directors were elected as follows: D. L. White, jun., Midland; W. P. Phin, Hamilton, Ont.; W. J. Sheppard, Waulbaushene, Ont.; and James B. Craven, New York. It was announced at the meeting that the company had purchased a hydraulic dredge of Canadian register to work here.

MONTREAL NOTES

Gates Refractories, Ltd., of Montreal, have recently obtained some good contracts for boiler installations and special firebrick.

The Interprovincial Manufacturing Company of St. Pie, Bagot, Que., are going to build an extension of 145 ft. x 50 ft. to their present plant for the making of casket coffins. Mr. Chaneux is the general manager.

At the conclusion of a tour of inspection of Canadian shipyards Sir James McKenzie, managing director of Vickers Ltd., of England, stated: "I am surprised at the magnitude of these yards and also at the economic layout of the plants, and I have seen the most modern machinery in these plants that exists anywhere to-day, and for the first time in my life I am ready to admit that there is a great future for the shipbuilding industry of Canada. I have no hesitation in saying that the acquisition of the companies owning these plants is absolutely essential, in my opinion, to the existence of the British Empire Steel Corporation. It will only be following out the same lines as have been adopted by the United States Steel Corporation and our big steel interests in England, where they have control of their shipping and shipbuilding plants."

INTERESTING BULLETINS

The Wellman-Seaver-Morgan Company, Cleveland, Ohio, have published a very thorough and attractive line of bulletins, covering some of their varied field of activities. The booklets show some interesting installations made by this company and are highly instructive. Following are the subjects which we have so far received:

Bulletin No. 41 deals with coal and ore handling machinery. The W-S-M. unloaders, travelling bridges with grab buckets, car dumpers, car haulages, transfer cars, boat loaders, bucket handling cranes, excavating buckets and weighing lorries are shown.

In Bulletin No. 42, special cranes are illustrated, pontoon cranes for marine work, dock cranes, shipbuilding cranes, cranes for concrete handling, and also some special purpose cranes.

The other bulletins received take up in detail the following subjects: No. 43 goes into the subject of hydraulic turbines; No. 44 shows hoisting and mining machinery; No. 45, steel works equipment; No. 46, coke oven machinery; No. 47, port and terminal equipment; No. 48, rubber machinery; No. 30, W.-S.-M. charging boxes; No. 26, tire running press; No. 18, the operation of a gas producer, and No. 19, superseding No. 13, illustrates their tire applying press.

Bulletin No. 22 gives the relations between power, shaft diameter, torsional stress, and speed of any shaft, and we hope in this latter case to present the charts for our readers' benefit.

All of these bulletins are prepared in splendid style, and we have been informed that they will be sent to anyone interested.

SPONSORS FOR SAFETY CODES SELECTED

Definite arrangements have been made for the formulation of a considerable number of safety codes under the auspices and rules of procedure of the American Engineering Standards Committee. The subjects of the codes for which arrangements have been completed, together with the organizations which have been designated by the committee to act as sponsors, and who have accepted such responsibility, are as follows: Abrasive Wheels.—The Grinding Wheel Manufacturers of the United States and Canada, and the International Association of Industrial Accident Boards and Commissions. Explosives.—The Institute of Makers of Explosives. Foundries.—The American Foundrymen's Association and the National Founders' Association. Gas Safety Code.—The U. S. Bureau of Standards and the American Gas Association. Head and Eye Protection.—The U. S. Bureau of Standards. Paper and Pulp Mills.—The National Safety Council. Power Presses.—The National Safety Council. Pressure Vessels, Non-fired. —The American Society of Mechanical Engineers.

Refrigeration, Mechanical.—The American Society of Refrigeration Engineers. Woodworking Machinery.—The International Association of Industrial Accident Boards and Commissions and the National Workmen's Compensation Service Bureau.

A number of additional codes are under consideration. A large representative advisory committee of specialists, organized by the National Safety Council, the National Workmen's Compensation Service Bureau, and the Bureau of Standards, at the request of the Committee, to act as its advisor, is actively working on the question of what additional codes are most urgently required and what organizations are in the best position to undertake sponsorship for such codes.

HYDRO-ELECTRIC ENTERPRISE

One of the largest electrical manufacturing groups in Great Britain has made efficient preparations for undertaking complete contracts for Hydro-Electric enterprises. The business of a prominent firm of water-power engineers and contractors has been acquired in order to provide facilities for making the largest sizes of water turbines, while the resources of the group are available for the electric generators, the construction work, the transmission of power, and all the other sections of Hydro-Electric work in any part of the world. Valuable patents have been acquired in connection with this development. A French company associated with the group is undertaking the construction of water turbines with a total output of 300,000 kilowatts, two hundred electrical locomotives, and other electrical machinery required in an important scheme of railway electrification.

* * *

The influence of the purity of oxygen on the cost of welds is investigated by a writer in "Autogene Metallbearbeitung." The author emphasizes the great importance of having pure oxygen for acetylene welding. Below 60 per cent. it is impossible to weld plates of 1-16 inch in thickness, and experiments have shown the cost of welds is increased by 2½ per cent. for every 1 per cent. decrease in the degree of purity of the oxygen. The paper is accompanied by two tables, one showing the consumption, the speed of welding, and the cost of welds, the other showing the comparative cost of welds made with different degrees of purity of the oxygen. The author concludes by stating that it is imperative to analyze the oxygen.

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Adjustable Collapsing Taps

Have overcome all the expense and annoyance of tapping screw threads with a solid tap.

Anyone doing thread tapping knows what backing out a solid tap each time means. It usually means low production, poor threads, and worn out taps. The mechanism of the Geometric Taps takes care of adjustment to correct diameter each time a thread is tapped, it collapses the chasers automatically, leaving a thread clean cut and perfect.

The chasers are readily reground, and when finally used up, are renewed at comparatively small cost, leaving the tap as efficient as when new.

The manufacturers of the Geometric line of Collapsing Taps and Self-opening Die Heads are justly proud of the distinction which is theirs:—

The Originators

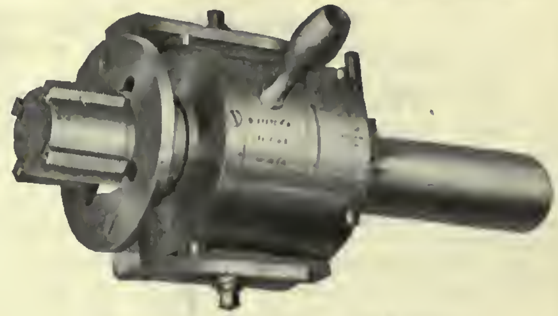
and the

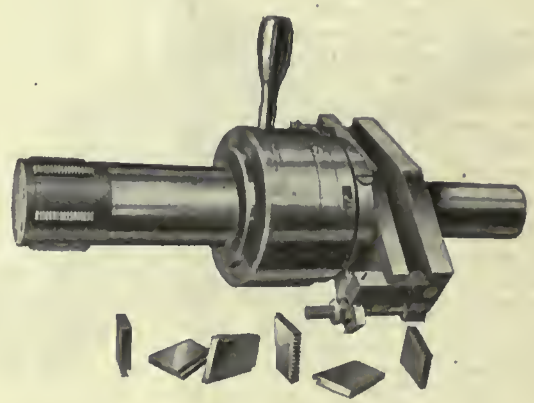
Largest and Best Known Manufacturers

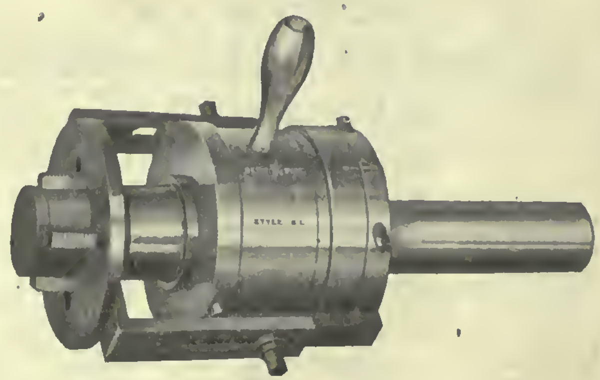
of

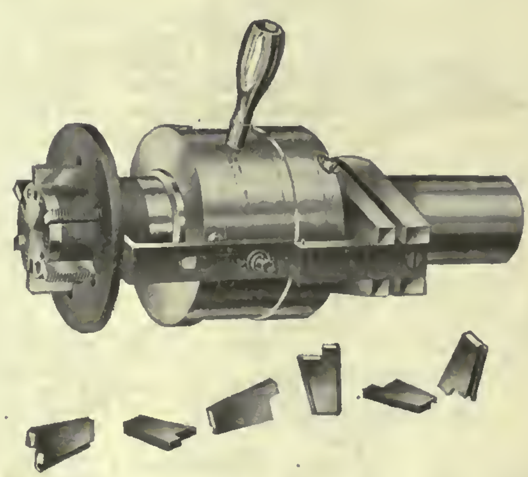
Automatic Threading Tools

For cutting all classes of screw threads, internal and external, of any diameter and form.









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CANADIAN AGENTS:

Williams & Wilson, Ltd., Montreal; The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg and St. John, N.B.; Canadian Fairbanks-Morse Co., Ltd., Manitoba, Saskatchewan, Alberta.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$42 40
Lake Superior, charcoal, Chicago	57 00
Standard low phos., Philadelphia	50 00
Bessemer, Pittsburgh	43 00
Basic, Valley furnace	42 90
Toronto price:—	
Silicon, 2.25% to 2.75%	52 00
No. 2 Foundry, 1.75 to 2.25%	50 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 50
Steel bars, base, Toronto	5 50
Iron bars, base, Montreal	5 50
Steel bars, base, Montreal	5 50
Reinforcing bars, base	5 00
Steel hoops	7 00
Norway iron	11 00
Tire steel	5 75
Spring steel	10 00
Band steel, No. 10 gauge and 3-16 in. base	6 00
Chequered floor plate, 3-16 in.	8 40
Chequered floor plate, ¼ in.	8 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	4 00
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 67 to 5 50
Small shapes under 3"	3 62

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

Gross.	Montreal	Toronto
Lake copper	$25 00	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	66 00	65 00
Spelter	12 00	12 00
Lead	11 50	11 00
Antimony	14 50	14 00
Aluminum	34 00	36 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 7 25	$ 7 25
Plates, ¼ up	6 50	6 50

PIPE—WROUGHT

Price List No. 44—April, 1920.

STANDARD BUTTWELD S/C

	Steel		Gen. Wrot. Iron	
	Black	Galv.	Black	Galv.
⅛ in.	$6 50	$ 8 50	....	....
¼ in.	5 18	7 26	$ 5 43	$ 7 56
⅜ in.	5 18	7 26	5 43	7 56
½ in.	6 84	8 42	7 27	8 84
¾ in.	8 45	10 58	9 03	11 16
1 in.	12 50	15 64	13 35	16 49
1¼ in.	16 91	21 16	18 06	22 31
1½ in.	20 21	25 30	21 59	26 68
2 in.	27 20	34 04	29 05	35 89
2½ in.	43 00	53 82	....	....
3 in.	56 23	70 38	....	....
3½ in.	71 30	88 32	....	....
4 in.	84 48	104 64	....	....

STANDARD LAPWELD S/C

	Steel		Gen. Wrot. Iron	
	Black	Galv.	Black	Galv.
2 in.	$30 90	$37 74	$34 60	$41 44
2½ in.	45 34	56 16	51 19	62 01
3 in.	59 29	73 44	66 94	81 09
3½ in.	73 14	90 16	82 34	99 36
4 in.	86 66	106 82	97 56	117 72
4½ in.	0 98	1 23	1 24	1 49
5 in.	1 15	1 44	1 44	1 73
6½ in.	1 49	1 86	1 87	2 25
7 in.	1 94	2 43	2 42	2 90
8-L in.	2 04	2 55	2 54	3 05
8 in.	2 35	2 94	2 92	3 51
9 in.	2 81	3 52	3 50	4 21
10-L in.	2 61	3 26	8 25	3 90
10 in.	3 36	4 20	4 18	6 03

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.

4½" and larger, 50%.

4" and under, running thread, 30%.

Standard couplings, 4-in. and under, 30%.

Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices.

Per 100 Pounds.	Montreal	Toronto
Copper, light	$15 00	$14 00
Copper, crucible	18 00	18 00
Copper, heavy	18 00	18 00
Copper wire	18 00	18 00
No. 1 machine composition	16 00	17 00
New brass cuttings	11 00	11 75
Red brass cuttings	14 00	15 75
Yellow brass turnings	8 50	9 50
Light brass	7 00	7 00
Medium brass	8 00	7 75
Scrap zinc	6 50	6 00
Heavy lead	7 50	7 75
Tea lead	4 50	5 00
Aluminum	19 00	20 00
	Per Ton	Gross
Heavy melting steel	18 00	18 00
Boiler plate	15 50	15 00
Axles (wrought iron)	22 00	20 00
Rails (scrap)	18 00	18 00
Malleable scrap	25 00	25 00
No. 1 machine east iron	32 00	33 00
Pipe, wrought	12 00	12 00
Car wheel	26 00	26 00
Steel axles	22 00	20 00
Mach. shop turnings	11 00	11 00
Stove plate	26 50	25 00
Cast boring	12 00	12 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜-in. and less	10
Carriage bolts, 7-16 and up	Net
Coach and lag screws	25
Stove bolts	55
Wrought washers	45
Elevator bolts	Net
Machine bolts, 7/16 and over	Net
Machine bolts, ⅜-in. and less	15
Blank bolts	Net
Bolt ends	Net
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square, blank ....add	$2 0
Nuts, square, tapped ....add	2 2
Nuts, hex., blank ....add	2 2
Nuts, hex., tapped ....add	2 5
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and
Boiler rivets, base ¾" and larger	$8 5
Structural rivets, as above	8 4
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cen
Set screws ....25 and	5
Sq. and hex. hd. cap screws	22½
Rd. and fil. hd. cap screws... plus	17½
Flat but. hd. cap screws .. . plus	30
Fin. and semi-fin. nuts up to 1-in.	20
Fin. and Semi-fin. nuts, over 1 in., up to 1½-in.	10
Fin. and Semi-fin. nuts over 1½ in., up to 2-in.	Net
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws ....list plus 20,	30
Thumb screws	40
Thumb nuts	75
Patch bolts ....add	20
Cold pressed nuts to 1½ in...add	$1 0
Cold pressed nuts over 1½ in..add	2 0

BILLETS

	Per gross to
Bessemer billets	$60 0
Open-hearth billets	60 0
O.H. sheet bars	76 0
Forging billets	56 00-75 0
Wire rods	52 00-70 0

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 7
Cut nails	5 8
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 5
Spikes, ¼ and 5-16 in.	8 0

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10½
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 35½
British Manila rope	0 28
New Zealand hemp	0 28
Transmission rope, Manila	0 47
Cotton rope, ¼-in. and up	0 88

POLISHED DRILL ROD

Discount off list, Montreal and Toronto .... net

Canada's Leading Tool House

Aikenhead's

Quality Tools for All Purposes

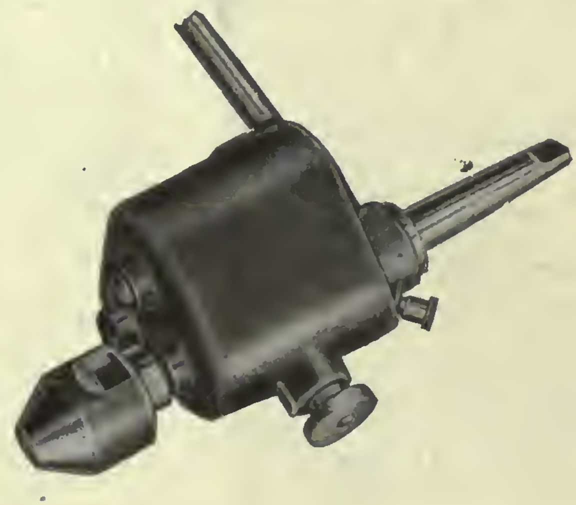
Johansson Adjustable Limit Snap Gages

Reduce Operating Expenses

Introduce the Limit System into your shop with a set of Johansson Limit Snap Gages. They are the accepted method of producing interchangeable work on a commercial basis. They incorporate in their design and construction every feature that sound engineering and mechanical sense dictate.

In these days when production costs are extremely high, every minute wasted by a mechanic, and every piece of work spoiled through inaccurate gaging eats up the profit. The fact that they eliminate both these wastes and that they get equal results even in the hands of unskilled operators accounts for their unusual success and hearty endorsation wherever introduced.

The Johansson book tells all about them. Write for your copy to-day.



Wahlstrom Automatic Tapping Attachment

A Cure for Tap Breakage

If the lands are freed from chips the tap won't jam in the hole. Consequently there will be no tap breakage. With the Wahlstrom tapping attachment the chips are freed by the oscillating motion which is a close reproduction of the simple to-and-fro motion of hand tapping. This reduces the tap breakage to a minimum.

The oscillating motion is changeable to a continuous revolution for tapping in soft materials. The spindle reverses when the tap is raised.

The Wahlstrom has nothing to get out of order and it fits any drill press. Made in two sizes: No. 1 takes taps of all sizes from 5-40 to ½ inch standard. No. 2 takes taps from ¼ inch. Sent on 10 days trial.

AIKENHEAD HARDWARE LIMITED

17, 19, 21 TEMPERANCE STREET, TORONTO

MISCELLANEOUS

Solder, strictly	$ 0 40
Solder, guaranteed	0 43
Babbitt metals	18 to 70
Soldering coppers, lb.	0 62
Lead wool, per lb.	0 16
Putty, 100-lb. drums	8 30
White lead, pure, cwt.	20 00
Red dry lead, 100-lb. kegs, per cwt.	16 50
Glue, English	0 40
Tarred slater's paper, roll	1 30
Gasoline, per gal., bulk	0 35
Benzine, per gal., bulk	0 35
Pure turp., single bbls., gal.	3 60
Linseed oil, raw, single bbls.	3 00
Linseed oil, boiled, single bbls.	3 03
Sandpaper, B. & A.	List plus 43
Emery cloth	List plus 37½
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin, "D," per lb.	0 14
Borax crystal and granular	0 14
Wood alcohol, per gal.	2 70
Whiting, plain, per 100 lbs.	2 75

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes	32½
Can. carbon cutters, plus	20
Standard drills, all sizes	32½
3-fluted drills, plus	10
Jobbers' and letter sizes	32½
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	net
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus 20 to	40
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At warehouse]

Rounds and squares	$7 base
Hexagons and flats	$7.75 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	60	75
Class B	27	37
Class C	18	27

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 8 50	$ 9 50
Sheets, Blue ann., No. 10	8 50	9 00
Canada plates, dull, 52 sheets	8 50	10 00
Can. plates, all bright	8 60	9 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	11 00	....
Fleur-de-Lis, 28 B.W.G.	10 50	....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28, U.S.	11 50	10 50
Premier, 10¾-oz.	11 50	10 90
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	29 50
1¾ in.	31 50	30 00
2 in.	35 00	30 00
2¼ in.	35 00	29 00
2½ in.	42 00	37 00
3 in.	50 00	48 00
3¼ in.	.. ..	48 50
3½ in.	63 00	51 50
4 in.	85 00	65 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	24½
Palacine	27½
Machine oil, per gal.	43½
Black oil, per gal.	18½
Cylinder oil, Capital	82
Cylinder oil, Acme	70
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	$2 60
Union thread cutting oil, antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil, bbls., net	13½

BELTING—No 1 OAK TANNED

Extra heavy, single and double	10%
Standard	10%
Cut leather lacing, No. 1	2 75
Leather in side	2 40

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 60
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	09
Pumice, ground	06
Emery glue	30
Tripoli composition	09
Crocus composition	12
Emery composition	10
Rouge, silver	60
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE

XXX Extra	.24	Atlas	.20
Peerless	.22½	X Empire	.19½
Grand	.22½	Ideal	.19
Superior	.22½	X Press	.17½
X L C R	.21		

Colored

Lion	.17	Popular	.13
Standard	.15	Keen	.11
No. 1	.15		

Wool Packing

Arrow	.35	Anvil	.22
Axle	.28	Anchor	.17

Washed Wipera

Select White .20 Dark colored .09

Mixed colored .10

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades... 15%

ANODES

Nickel	.58 to .65
Copper	.38 to .45
Tin	.70 to .70
Zinc	.18 to .18

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10..		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6 x 4 base	45 00	44 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 75	$14 50
Sheets, 3½ lbs. sq. ft.	10 50	14 00
Sheets, 4 to 6 lbs. sq. ft.	10 25	13 50

Cut sheets, ½c per lb. extra.

Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .23
Acid, hydrochloric	.03¼
Acid, nitric	.10
Acid, sulphuric	.03¼
Ammonia, aqua	.15
Ammonium, carbonate	.20
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, annhy	.41
Copper, sulphate	.16
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.08
Nickel carbonate	.32
Nickel sulphate	.19
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.25
Silver nitrate (per oz.)	1.20
Sodium bisulphate	.11
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.18
Tin chloride	1.00
Zinc chloride, C.P.	.30
Xinc sulphate	.08

Prices per lb. unless otherwise stated

COAST TO COAST

STEEL & IRON PRODUCTS OF EVERY DESCRIPTION

THE STEEL COMPANY OF CANADA LIMITED

HAMILTON MONTREAL

FOREMAN IN THE PLANT IS THE KEYMAN IN ACCIDENT PREVENTION

R. M. Little, of the National Safety Council, gave several addresses last week to various sections of the Steel Co. of Canada staff at Hamilton. He went fully into the history of the movement, and gave many facts and figures.

The safety measures, he declared, must be looked at from a human point of view, in order that the men might be preserved in good health and free from injury and impairment, to their wives and children. The worker, unless he was protected, was subjected to all kinds of dangers, due to the amount of machinery used in the modern plants now, and many of which dangers he did not formerly have to contend with. At this point the speaker gave a number of actual figures of accidents in plants in the States and these were very interesting. He said that 2,000,000 lost time accidents had been reported during one year, of which 75,000 would be off work for two weeks or more, and 22,500 would never return to their jobs, while from 15,000 to 18,000 suffered impairment for life, thus reducing their economic efficiency 50 per cent. This was the human toll taken by accidents. A tremendous need for the safety movement had sprung from these incredible losses, and it was necessary to form practical methods of combatting the menace.

"Everyone should be interested in the safety movement," he said. "It is a mutual benefit movement. It bears close semblance to a crusade." It object was definite improvement, and in the States alone some $77,000,000 had been expended in various ways by the National Council which had been the means of saving 25,863 men from injury and death. He then told of the safety system as it has been adopted by plants in the States, and laid particular emphasis upon the remarkable decrease in accidents following their adoption. Mr. Little advocated the adoption of a supervisor, the distribution of safety literature, the spreading of careful instruction and the holding of safety meetings. He emphasized the value of team play and co-operation, and spoke of the success of the movement in Akron, Ohio.

"These accidents can and will be prevented, and I feel confident that this plant will make a reduction of from 30 to 35 per cent. in the number of its accidents in the next year. The movement will bring further harmony in the plant."

He stated that the foreman in a plant is the keyman and that it is his duty to take a personal interest in each employee, and his concluding statement was to the effect that the time has come for us to recognize the value of safety, especially following the great loss of life in the war.

STEEL CORPORATION HAS SPENT OVER $71,000,000 IN ITS WELFARE ACTIVITIES

Some idea of the extent to which welfare work has been carried on by the U. S. Steel Corporation, and the wide scope covered, can be gathered from the following resume, given by the director of that department.

HE'S GOTTA COME DOWN
—Talburt in the Toledo "News-Bee."

Sanitation, including the furnishing of pure drinking water, the expenditure for this work last year amounting to over $3,000,000.

Plant restaurants, where wholesome food is provided at moderate cost and other benefits are enjoyed.

Clubs, including dormitories, reading room and library, gymnasium and swimming pool, baths, auditorium and dance hall, billiard and pool rooms, bowling alleys, basket ball, halls with motion pictures, lectures, concerts, smokers, etc. Good Fellowship clubs organized by employees help members who are in need.

Gardens where flowers are cultivated and vegetables are raised.

Visiting nurses who tend the sick, give instructions in personal and domestic hygiene and domestic science, help families to deal with financial, physical and marital and other domestic troubles, and conduct day nurseries.

Practical housekeeping centres where there are classes for children in sewing, cooking and housekeeping, meetings for the instruction of women, clubs for small girls and boys, and clubs or associations for women employees.

Playgrounds, which are enjoyed by thousands of little folks.

Picnics, which are attended by very large numbers, one at Duquesne, Pa., by 20,000 people.

Musical organizations, including the famous Liberty Chorus, composed of employees from two plants of one of the Western subsidiary companies. This chorus appeared many times for war activities, and made a special trip at its own expense to New York to sing at meetings at the Carnegie Music Hall, on the steps of the Sub-Treasury Building, and other places.

Dental clinics, where the teeth of children are properly treated and the tooth-brush drill is made the opening exercise every day in school. Service is

also provided for adult employees at reduced costs.

The stock subscription plan which last year resulted in 66.311 employees subscribing for stock in the corporation,

Pensions, which are granted to retiring employees.

Since the inception of this work the following amounts have been spent on it:

	Totals
Welfare	$11,751,428.02
Sanitation	11,732,666.20
Accident prevention	6,530,706.43
Relief for injured men and the families of men killed	22,652,237.68
The employees' stock subscription plan (approximate)	9,160,000.00
For pension fund payments in excess of income provided by permanent fund	1,824,692.56
Note—Total pension payment to employees for additional benefit payments and administration cost	4,819,357.63 294,212.57
For the creation of a permanent fund	8,000,000.00
Total	$71,651,731.89

PLANNING FOR NEW FREIGHT SERVICE

Canadian Government Railways Have Several Schemes Under Way to Extend Trade

The Canadian Government Mercantile Marine has a further extensive programme of expansion under way, though delivery of ships now on the stocks on time will decide the rapidity with which it can be put into effect.

The first new services will be to the Orient from both Atlantic and Pacific ports, and R. C. Vaughan, assistant to President D. B. Hanna, stated that the Atlantic service had practically been decided upon. It will be inaugurated next August with the sailing of a steamship from Montreal to India, via the Suez canal, calling in all probability at Karachi, Bombay and Columbia. If a sufficiency of freight offers, it is probable that a regular service will be maintained from Montreal in summer and a maritime port in winter.

A number of new services are under consideration, Mr. Vaughan states. Data are being compiled at the present time and much depends on the prompt delivery of new bottoms, for C. G. M. plans have been more or less interfered with by delay in delivery of new ships, due largely to labor troubles in the shipyards.

The second new service will also be to the Orient and will run from Vancouver, calling probably at one or two Chinese ports, then on to Singapore, Straits Settlements, then to Calcutta. Rangoon may also be a port of call. Still other services are contemplated, but no definite decision has been reached.

NEW EQUIPMENT ORDERED FOR 1920

National Railways Have Placed Orders For Additions to Their Present Ontfit

The Canadian National Railways have ordered their new equipment for the year 1920. The new contracts call for 117 locomotives of various types, freight cars, refrigerators, cabooses and ballast cars to the number of 5,556; passenger coaches, sleepers, diners and baggage cars, 100. During the past year 985 passenger cars of all types were delivered, including colonist and baggage cars; 2,200 freight cars, including 750 steel-frame box cars, and 82 passenger cars with diners and observation cars. Of the 1919 contracts there remain to be delivered 13 observation buffet compartment sleepers and 13 first-class coaches of steel construction.

DON'T GET CAUGHT NAPPING OFF BASE

What Hamilton Man Thinks of the Present Situation in Sheets and Plates

In the memory of some of the oldest merchants, iron and steel sheets and plates were never so scarce or deliveries more uncertain for such a period of time as at present.

A. T. Enlow, president of the Dominion Sheet Metal Corporation, Ltd., Hamilton, Ont., in discussing the sheet and plate situation, stated:—

The whole world is short of sheets, but particularly are stocks in Canada depleted now. The automobile interests have had their fill while others waited. and now a better supply may reasonably be expected to flow again in accustomed channels, but at what price is a matter of conjecture.

It is, perhaps, a somewhat trite statement to make, but nevertheless true. that one cannot with any accuracy foretell coming tendencies in the steel world, and particularly as to black and galvanized sheets.

The market will undoubtedly be most largely influenced and governed by events occurring in the United States, and if there was any considerable production for a decent period I am quite confident that United States sheet prices would recede.

The question remains—Will production resume in large volume, or will strikes, embargoes, laziness, politics, and innate "cussedness" continue to hamper and reduce it?

I am still of the opinion that at present "topnotch" prices one should buy only for immediate and reasonably sure resale and let the future take care of stock at prices which will certainly be much less than at present.

It is not wise, however, to miss a sale and a profit, however high the price may be, and people must have a certain amount of steel sheets to enable them to "carry-on." Play the game, but don't get "caught napping" off the base.

TRADE GOSSIP

Given Increase. — Official announcement has been made to the effect that all the employees of the Canadian Locomotive Works at Kingston, commencing June 15th, receive an increase of fifteen per cent. in wages. About ten days ago there was a report that the company had decided to increase the wages 10 per cent., in fact some of the unions had accepted the proposed increase and had signed up for a period of one year. It is stated that the increase was not acceptable to all the unions as some had asked for an increase of 25 per cent. The 15 per cent. has been accepted.

Building Additions. — Three big contracts, totalling probably half a million dollars, are said to have been awarded by Canadian National Railway directors at a meeting in the central offices, Toronto St., Toronto. One of the largest pieces of Canadian National Railway work pending, the Prince Albert north extension, was not dealt with, no tenders having been received. The three awards are: Acadian Valley extension, to John Timothy, at a unit price; Turtleford extension, to J. W. Miller, Western Construction Co.; McGiveny Junction, N.B., revision contract, to H. R. Stewart. In each instance the contract was awarded to the lowest tenderer. Each of the construction works involves an expenditure of over $100,000.

TENDERS

The Naval Service, at Ottawa, is receiving tenders up to August 2 for the following ships: Niobe, steel cruiser, armored; Rainbow, steel cruiser, which could be used as a cargo vessel with slight alterations; The Grilse, oil burning steel pleasure yacht; Canada, steel, built in 1904. The Rainbow is lying at Esquimalt, B. C., and the others at Halifax.

Big Order Received.—The rolling of a 7,500-ton rail order was started at the rail mill of the steel company at Sydney. This order has been received from the Canadian National Railways, and will keep the rail mill running for a period of six weeks. A conference was held between representatives of the striking machinists, 115 of whom have been out now for two months, but nothing definite was arrived at. The company offered a compromise wage advance, but refused to grant them a nine-hour day.

Incorporation has been granted to Dominion Motor Car Co., Winnipeg, for making, buying. selling, etc., motors, bicycles, etc. The capital is $400,000.

INTERESTING ITEMS TO BE FOUND IN THIS WEEK'S ADVERTISING SECTION

Are you getting production proportional to your wage increase? If not, one answer is to be found in this issue.

A city that boasts of its industrial advantages.

An important announcement regarding a new book which can be procured free.

A tool manufacturer who claims he has enjoyed 15 years of satisfied users.

A machine that takes the kinks out of wire.

Something that reduces the cost of maintenance.

A machine that turns out axle bands for wheeled floor toys at the rate of 1,000 per hour.

A goggle that has a non-twisting front.

How to overcome the summer slump.

Why a workman is the best judge of a file.

A device that holds either straight or taper work.

When it is not wise to experiment.

A big thing to watch in ball-bearings.

The fact that reamer blades must be accurate.

A metal that is claimed to be the master of steel.

Something that's known from coast to coast.

Incorporations

written √— or "√— as the case may

The Autostrop Safety Razor Co. has increased its capital from $20,000 to $125,000.

Incorporation has been granted to Collingwood Shipbuilding Corporation, with capital stock of $100,000. The chief place of business is to be at Montreal. The powers of the company are very wide and take in a large number of future possibilities.

Port Arthur Shipbuilding Co. has been incorporated, the operations to be carried on throughout the Dominion of Canada. Capital stock $100,000. Head office at Montreal.

The Kemp Metal Auto Wheel Co. has been granted incorporation to buy, sell, make, etc., auto and metal wheels in all their branches, etc. Capital stock, $100,000, and the head office in Toronto.

The C. P. H. Gas Engine Co. of Canada has been incorporated at Ottawa, with capital at $100,000, and head office at Montreal. The company is empowered to make, operate, sell, etc., meters or engines bearing the trade mark "C. P. H."

Higher Prices for Gas.—The Brantford city council protested against the increased price of gas from 45 cents to 85 cents per thousand, but on account of the agreement which the city drafted in 1904, and which gave the gas company the right to the increase, the city will not be able to fight it.

Trade Gossip

Meeting of Nova Scotia.—A meeting of the shareholders of the Nova Scotia Steel & Coal Company has been called for June 25th. The meeting will be held in New Glasgow, and the chief business will be the ratification of the merger with the Dominion Steel and other concerns which will make up the British Empire Steel Corporation.

Coming From Germany.—According to an Ottawa despatch the articles being imported from Germany into Canada at the present time are chiefly metal, for use inclusively in mining or metallurgical operations, machinery composed wholly or in part of iron or steel, and iron or steel integral parts thereof, musical instruments and precious stones, while the importation from Austria is practically confined to electric insulators. This information was given in answer to a question by Fernand Rinfret (St. James, Montreal), in the House of Commons.

New Cockshutt Warehouse. — The Cockshutt Plow Co., Ltd., who for the past four years have had their offices over the C. N. R. Telegraph office in Edmonton, are erecting a two-story brick building with a full concrete basement on 9909,102 A. on Rice street, opposite the city market square. The building will be fifty feet wide and eighty-five fet long. The main floor will be used as a display room, while the second floor will be used entirely for offices, from which all of the company's work for central and northern Alberta will be directed. Manager Fred Pickles says that business in the machine line this year is better than ever, and that the prospects for the future are better than at any time during the five years that the company have had their offices located here. With a display room in the centre of the city he expects that they will be able to more efficiently handle the local trade.

ARMOR PLATE SCRAP AT SANDY HOOK

The Oxweld Acetylene Company, of Newark and Chicago, which was recently awarded the Government contract for cutting 4,000 tons of armor plate scrap to charging box size at Sandy Hook, now has a crew of oxy-acetylene cutter on the job. The plates, 3 in. thick by about 9 ft. by 13 ft., weigh between seven and eight tons each, and are being cut into sections 13 in. by 25 in., each weighing around 300 pounds. The weights vary somewhat owing to the necessity for cutting through the shell holes, each plate having been punctured six times by heavy artillery shells for which they were made the targets in the big gun tests conducted at Sandy Hook during the war.

This is one of the largest jobs of the kind that has ever been undertaken and several weeks will be necessary to complete the work.

A B C OF WELDING

(Continued from page 577)

ordinarily required. This is because of the severity of this test—the natural tendency being for the break between the plates to continue in the same direction.

The applications of the fillet weld in its varied forms are unending. When properly executed it forms a perfect bond that will endure strain from whatever direction it may be applied.

As ordinarily executed penetration even of the 90 degree angle between the two sections of metal is seldom secured. The amount of filler added should be kept at a minimum, the chief function of the rod being to protect the vertical piece of metal A. It is held at all times near the top of the weld, and tends by its capillary action to support the melted metal in the position shown.

The chief difficulty to be eliminated is the tendency to speed up the weld at the expense of lack of penetration, and a certain tendency to form "craters" or "blow holes" in the weld. When these are formed they can be eliminated only by going continually around them with the flame. Any attempt to melt them out by holding the flame within the crater will prove but waste of effort.

In making tests of welds of this character all efforts should be directed toward hammering the vertical plate A down over and across the weld. It will be found as soon as the operator is able to secure proper penetration and form a line of beads on the reverse side of this plate that the weld cannot be broken open by hammering.

Classified Opportunities

POSITION WANTED

MECHANIC AND SALESMAN, AGED 35, would take European engagement for year or more. Understand metric system, French, English and Scandinavian. Prefer automotive work. Box 688, Canadian Machinery. (c1m)

HELP WANTED

WANTED — MAN TO SET UP AND TAKE charge of Gleason straight tooth gear cutters. Must be able to handle men. Salary commensurate with ability and experience. Apply Employment Manager, McKinnon Industries Ltd., St. Catharines, Ont. (c26m)

DIE SINKER WANTED—FIRST-CLASS MAN only. Best working conditions and top wages. Apply Employment Manager, McKinnon Industries Limited, St. Catharines, Ont. (c26m)

SALESMAN FOR MACHINE TOOLS SUPplies. Must be a high grade man of engineering knowledge, and good address; for such there are excellent prospects. Address giving full particulars in confidence. Jas. Buckley Co., St. Nicholas Bldg., Montreal. (ctfm)

PLEASE MENTION THIS PAPER

MACHINE WORK WANTED

MACHINE WORK WANTED FOR LATHES, shapers, milling machine and planer, etc. Hourly or contract basis. Prompt delivery. W. H. Sumbling Machinery Co., Toronto. (ctfm)

MACHINERY WANTED

SMALL POWER PRESS SUITABLE FOR trimming light forgings. Apply Wheeler Needle Works, Paris, Ont. (c3m)

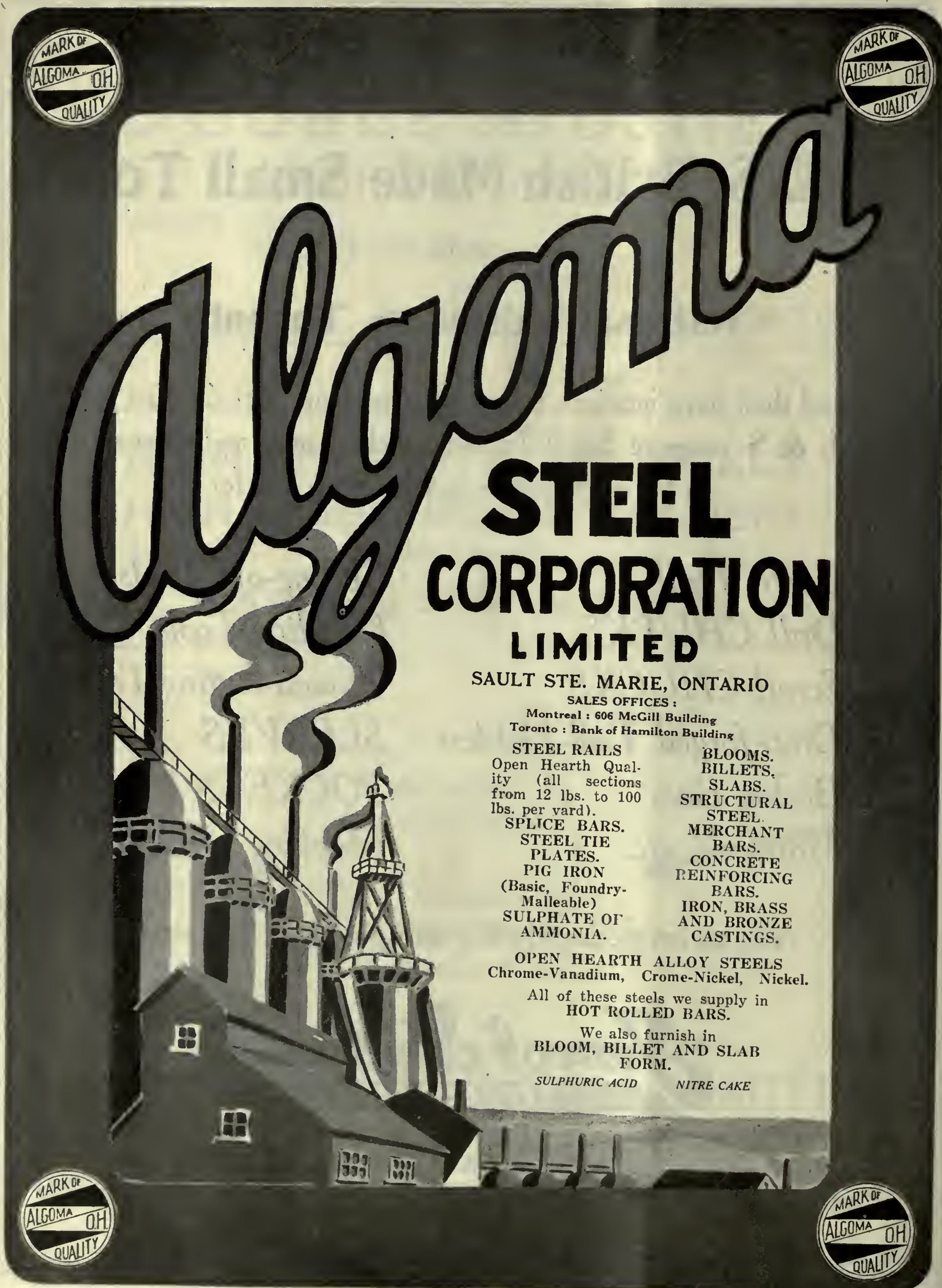
ONE END POLISHING LATHE, 30", WITH 12" spindle. Apply Box 686, Canadian Machinery. (c24m)

PATTERNS

TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (ctfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

Canadian Machinery and Manufacturing News, June 24th, 1920. Vol. 23, No. 26. Published weekly at 143-153 University Ave., Toronto, Canada. Subscription price in Canada, $3; United States, $3.50. Entered as second-class matter at the Post Office Department, Ottawa, Canada. Entered as second-class matter July 1, 1912, at the Post Office Department at Buffalo, under the Act of March 3rd, 1879.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SLABS.
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All of these steels we supply in HOT ROLLED BARS.
We also furnish in BLOOM, BILLET AND SLAB FORM.
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"Where there's a WILT - there's the Way"
Quick Deliveries
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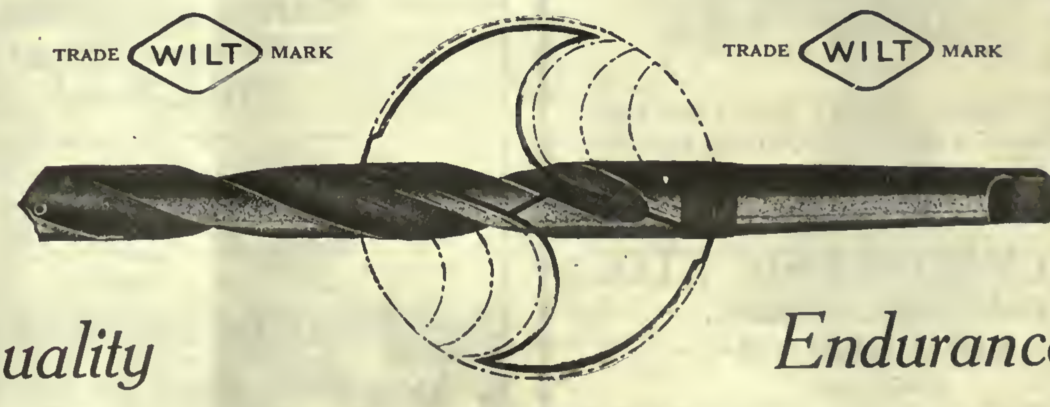
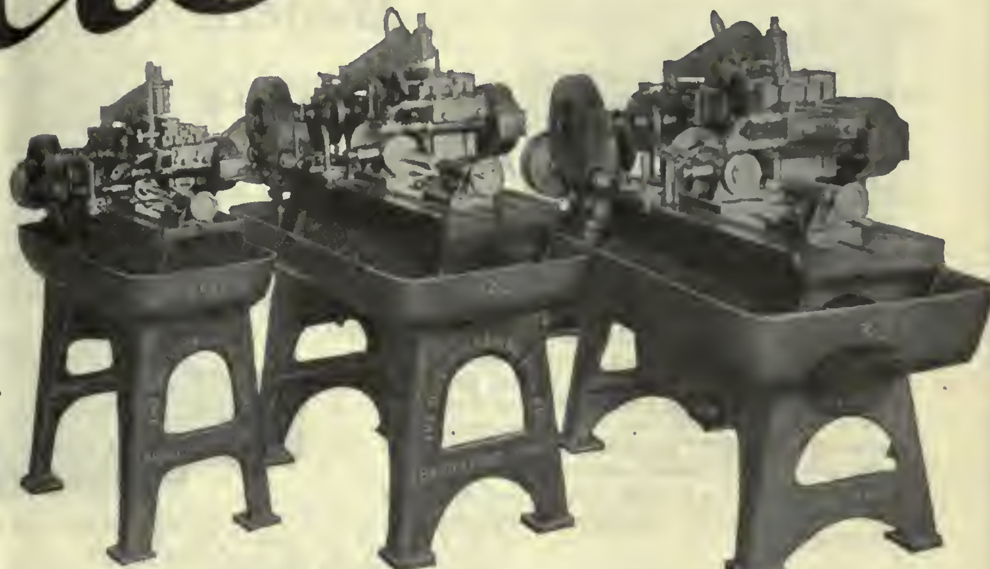


Bilton GEAR MILLERS



Fully Automatic

Their adaptability is almost unlimited on small work—such as cutting spur, bevel, miter, angle gears, saws, ratchets, sprockets, cutters, knurls, taps, cylinders, form cutting, manufacturing, milling, etc.

A big time saver, as indexing takes place during return stroke of cutter — which is removing metal 90% of the time.

Write us for Catalog 30-6

Over 500 leading manufacturers now use the Bilton for high production on accurate work

Bilton Machine Tool Co. Housatonic Avenue **Bridgeport, Conn., U.S.A.**

Foreign Agents: Alfred Herbert, Ltd. Chas. Churchill & Co., Ltd.

STEEL CASTINGS

We shall be glad to supply, in addition to our General Catalogue, literature on

Steel Castings	Lithographed Ware
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made by the Acid Electric process up to fifteen tons. Castings made by this process are free from blow holes, easy to machine, and superior in every way to ordinary Steel Castings.

Castings supplied for shipbuilding, cars, locomotives, all classes of machinery, etc.

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—*for a large variety of grinding*

if your variety of grinding is large invest in a Manhattan Universal Grinder. It is capable of handling cylindrical or internal grinding with the utmost in speed and accuracy.

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Manhattan All-Around UNIVERSAL TOOL GRINDER

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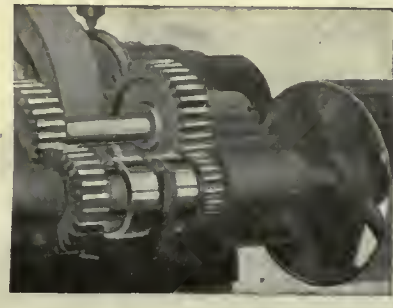
2

THE JOHNSON FRICTION CLUTCH



Modern Machine Tools Require Good Clutches

and Johnson Clutches are furnished as regular equipment on a large majority of the best machine tools made.

Exceptional qualities are required in a friction clutch tc make it operate with the precision demanded by modern machine tools, and stand up under the service that the ordinary machine tools must perform.

The clutch that has proved its ability on hundreds of such installations is capable of good service anywhere.

Here is a common Johnson Clutch application—a double clutch mounted between spur gears for change of speed with single pulley drive. Where two speeds are needed on continuous production work, the greater convenience and superior endurance of Johnson Clutch control are invaluable.

Write for our Yellow catalog and Booklet, "Clutches As Applied To Machine Building."

DOUBLE CLUTCH EXTERIOR

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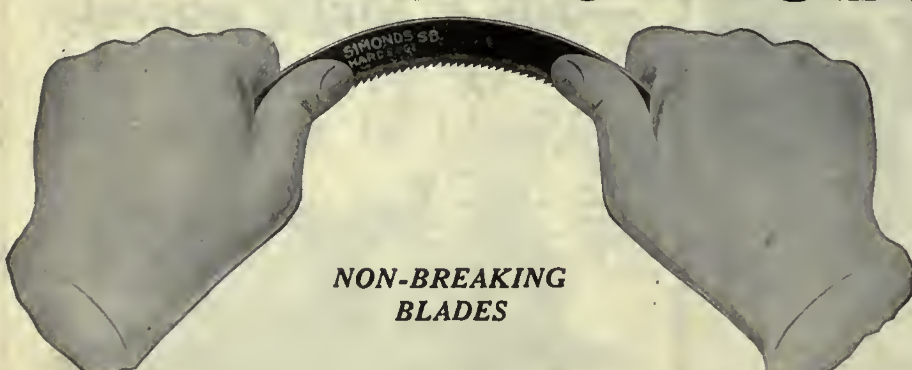

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Any Size or Length

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Continuous forge furnaces, and furnaces for heating, melting, reheating, heat treating, annealing, hardening, sherardizing, and welding — Any industrial process requiring heat.
The only distinct advance in furnace practice since Siemens' time.
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Well designed and strongly built cranes of this type will improve your shop. They will be a decided saving. Free moving hand cranes can be supplied at low cost.

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Hand, overhead with electric hoist.

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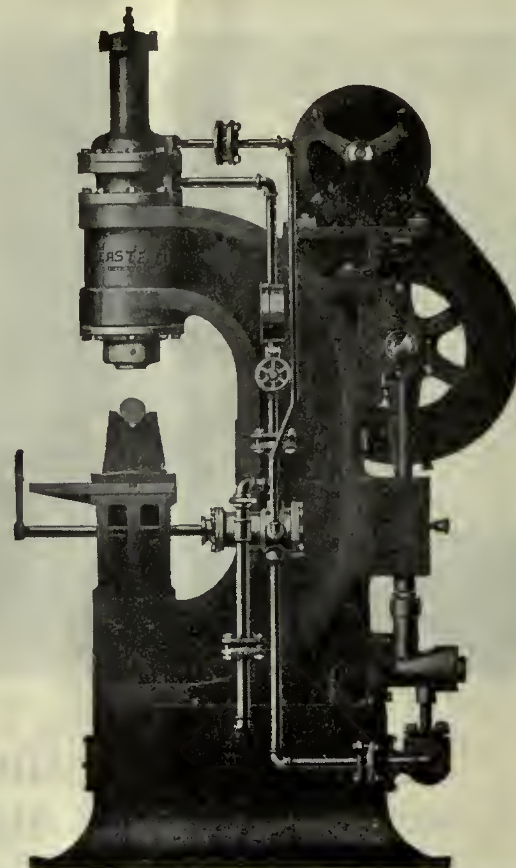

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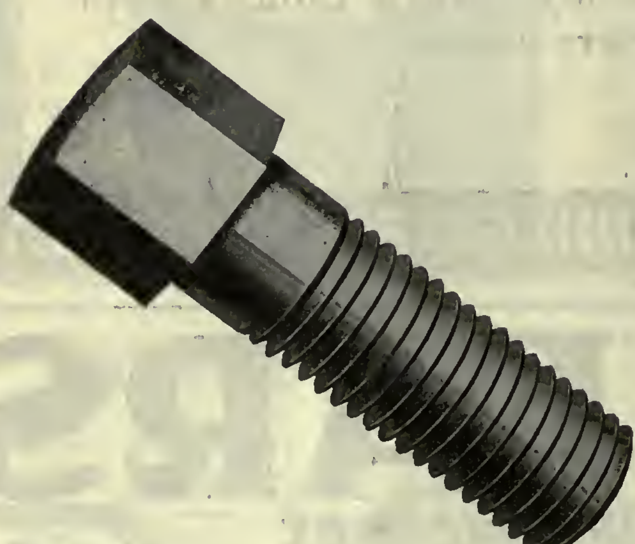
Screw machine product up to $2\frac{1}{4}''$ diameter to customers' specifications.



Owing to the market shortage of raw material, it is to the customers' advantage that they anticipate requirements as far ahead of use as possible.

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UPWARDS of 125,000 Little Giants, now the world's standard air drill, are giving faithful, economical service.

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Both in manufacture and application, Little Giant quantity is based on *quality*.

Exacting tests by skilled metallurgists maintain proper physical properties of all metals composing each Little Giant part.

Research engineers are constantly contributing to the further perfection and utility of Little Giants, as evidenced by their many exclusive features.

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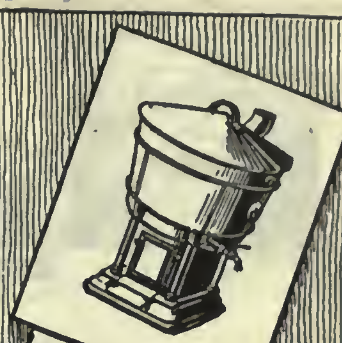

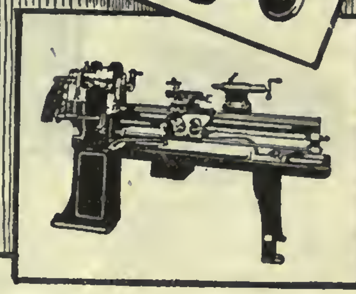

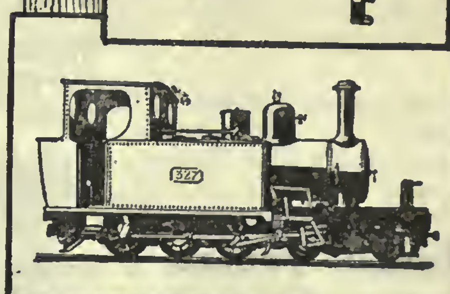

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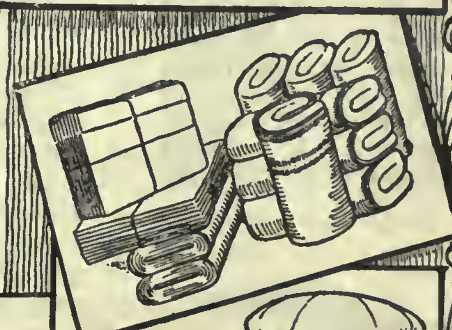
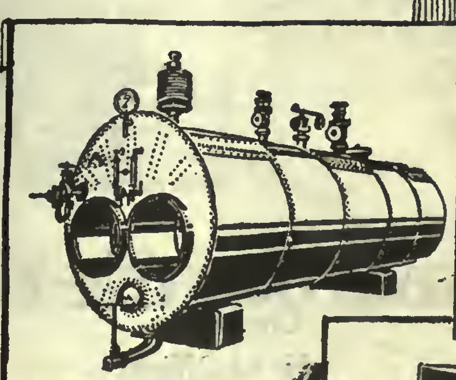
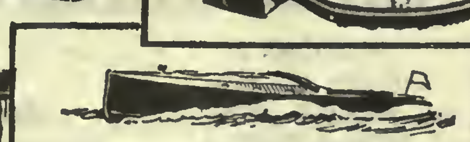


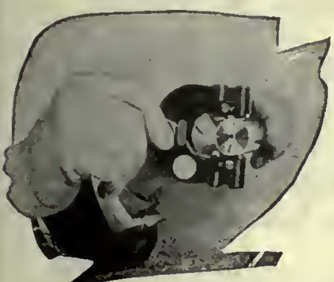




Pointers on Better Gaging

Right and Wrong Ways of Holding Snap Gages

It has been suggested that we devote a chapter of "Pointers on Better Gaging" to the subject of holding Snap Gages while inspecting—particularly in reference to the insulated grip found on all Johansson Adjustable Limit Snap Gages. There is considerably less trouble experienced in using the smaller sizes because their lighter weight makes them easier to handle. It should be borne in mind, however, that the insulated grip is perhaps of greater importance here, as the heat of the hand acts more quickly, there being less metal to be affected. Another important point in connection with the "finger hold" on Snap Gages of this type is that it permits them to be handled more readily. Although no sensitive touch is required with Johansson Gages, the gaging plugs will pass over the work more easily and quickly if the Gage is held correctly. The ease with which the Gage is used decreases the wear on the gaging plugs and prolongs their life and thus postponing the time when it becomes necessary to relap and reset them. If a Snap Gage is always held by the finger grip, its efficiency as an inspection tool is increased. A "Go" and "No Go" Snap Gage is a quick, accurate tool when correctly handled no matter how many different INSPECTORS are using it. Carelessness in holding a gage of this type should at all times be discouraged.



CORRECTLY HOLDING SMALL GAGE BY FINGER GRIP

One of the most efficient methods of gaging on medium sized work is to have a stationary rack or fixture for holding the piece inspected while the Snap Gage is passed over it. If the gage is then held correctly, the temperature change becomes a negligible factor and the INSPECTOR can handle his gage with much greater ease.

AWKWARD AND WRONG METHOD OF GAGING

The greatest difficulty with correct holding has been with the larger and heavier "Snaps." Here the tendency has been to firmly grasp the gage either around the middle or with two hands on the sides as illustrated. It takes a comparatively short time for the temperature which is thus created to affect the accuracy of the gage. When gaging large work which is held stationary in a fixture, suspend the gage vertically above it by the finger grip and let the weight of the gage gradually carry it down over the work. If the gage is to be held at an angle or "run in" from the side as is frequently the case when gaging while the work is in the machine, balance the weight with two fingers of one hand at the lower end and swing the gage with the other, holding it by the insulated grip as shown in the bottom illustration.

TEMPERATURE IS SURE TO AFFECT GAGE WHEN HELD THIS WAY

INCORRECTLY TRYING TO USE A LARGE SNAP GAGE WITH ONE HAND

The part that Adjustable Limit Snap Gages play in the operation of the Limit System is described in the Johansson catalog which will be gladly sent on request.

THE RIGHT WAY TO HOLD A BIG SNAP GAGE

C-E-Johansson-Inc Johansson ACCURACY **Poughkeepsie-N-Y**

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Greater Production A World Necessity

THERE can be no slackening of production of manufactured goods. World demands are greater now than ever. Working hours are shorter. Men and machines must produce every minute. A big factor in continuous production is the quick lacing of power belts. The leading industrial plants of the world have installed "Clipper" lacing because

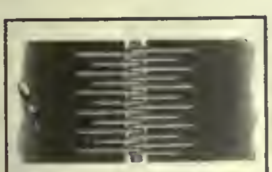
The Clipper Belt Lacer
Laces a Belt in Three Minutes

It is the quickest, simplest and most satisfactory method of belt lacing ever devised. Old methods took from fifteen minutes to half an hour to make a crude joint. The "Clipper" joint is smooth, flexible, safe and lasting. Any factory workman can use the "Clipper." Its cost is negligible, its saving beyond estimate. On request the "Clipper" will be sent to manufacturers for free trial at our expense.

Most mill supply houses sell the "Clipper."
Dealers not stocking it write for particulars.

"The Connecting Link Between Power and Production"

Clipper Belt Lacer Company
GRAND RAPIDS, MICHIGAN, U. S. A.



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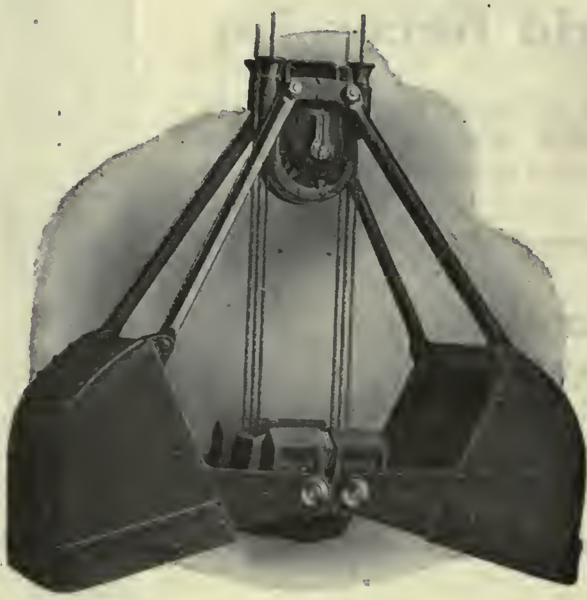
GRAB BUCKETS *and* Hoisting Machinery

Manufactured in Canada



TYPE U BUCKET

¾ to 2 Yd. Capacities

This particular bucket is made for coal handling and for operation of transporters or travelling cranes.

Hoisting Engines, Derricks

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High Speed Steel

Electric furnaces, automatically regulated, the most modern methods, and the introduction of Uranium — make this a steel of truly remarkable cutting properties.

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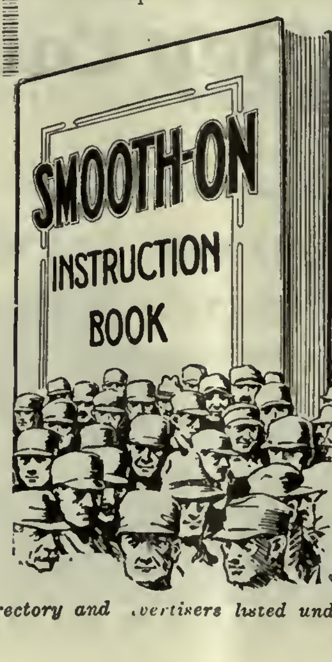
What Other Engineers KNOW About Repair Work, This Free Book Tells YOU

It is full from cover to cover of practical ideas developed to meet actual emergencies. There is no theory in the



Smooth-On Instruction Book

Its 144 pages of *real facts*—facts that—if you knew them—might save you hours—or days—and dollars in your next repair job.

Write for it to-day—It's FREE

Smooth-On Mfg. Co.
Jersey City, N.J., U.S.A.

MATTHEWS STEEL STAMPS STAND CLOSE INSPECTION

Under a glass the heavy uniform Bevel—the neat, accurately formed characters—show clearly why Matthews Pittsburgh Bevel Steel Stamps give better, clearer impressions and longer service.

If you are interested in "Better Marking" and "Marking Economy," our new Steel Die Catalogue offers useful suggestions.

Your copy awaits request by card or letter.

MAKERS OF MARKING DEVICES SINCE 1850

JAS. H. MATTHEWS & CO.

1716 FORBES FIELD, PITTSBURGH, PA, U.S.A.

Dunbar

Springs *for* Every Use

We have been making springs of all kinds for 70 years. Let us advise you when in difficulty.

Tell us the purpose for which the spring is intended, and experts will gladly co-operate to see that you get the design best suited to the purpose.

Dunbar Springs are thoroughly tested for **accuracy** and **quality**. Send us specifications, for estimates.

THE DUNBAR BROS. CO.
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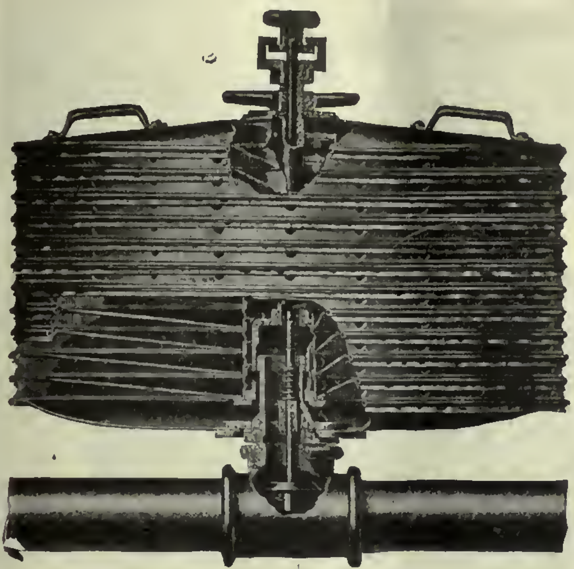
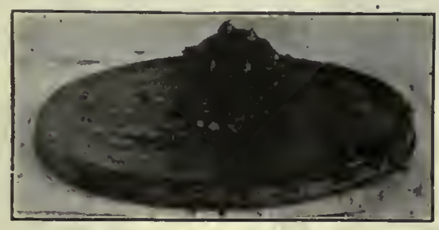


No. 1—Sectional View of Bowser Filter Section Assembled.



No. 2—Filter Disc with dirt filtered from oil.

The pictures shown illustrate the Bowser Filter Section as used in the Bowser Oil Filter.

No. 1 shows the Filter Section assembled, ready for use. No. 2 shows one of the Filter discs with dirt that the Filter has collected from used oil. This pile of dirt is about 6 in. in diameter and from 2 in. to 3 in. high.

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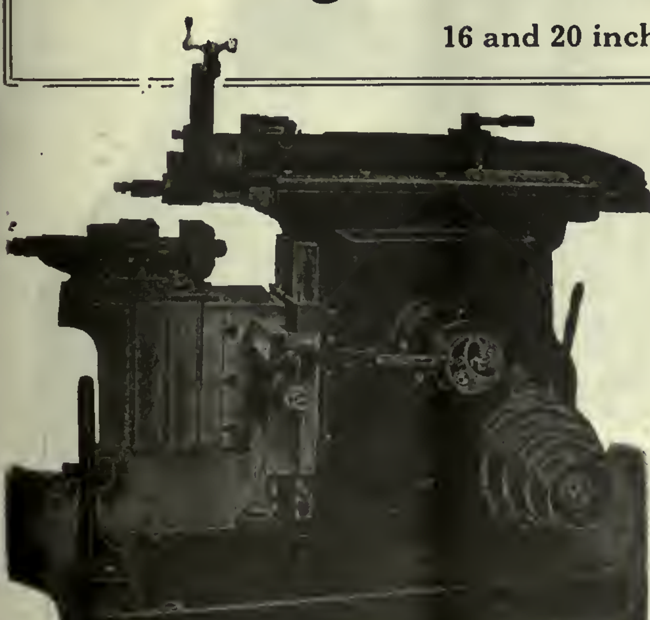

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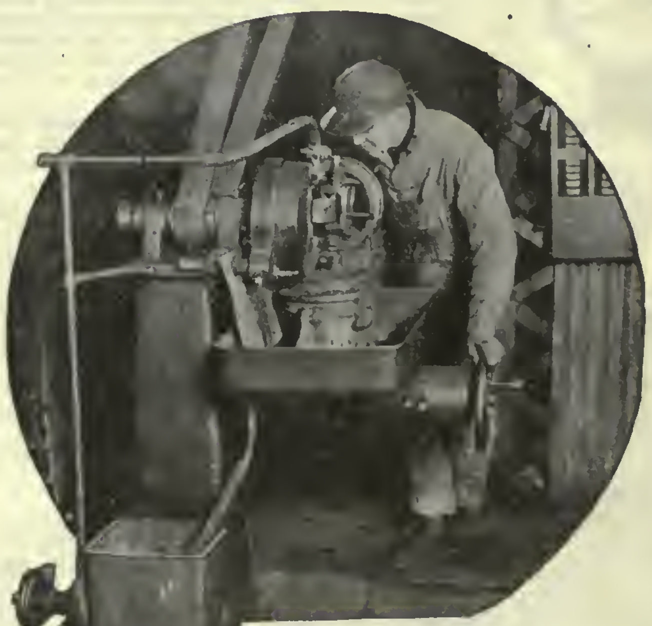

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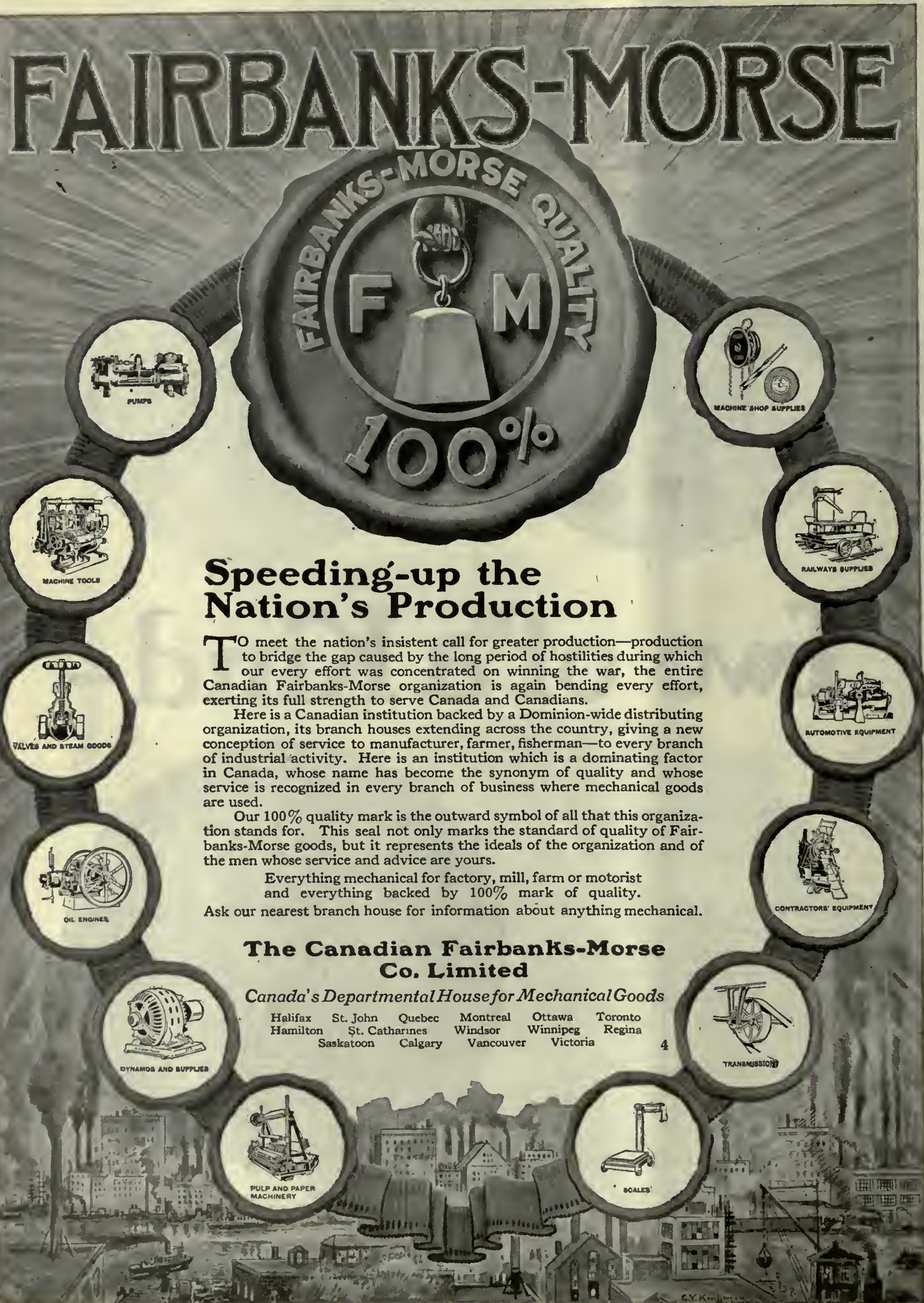
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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Vol. XXIII., No. 26 June 24, 1920

Boring as It Was Accomplished 80 Years Ago

Machine Shop Methods Have Improved Wonderfully in the Last Eighty Years. They Certainly Needed to, Judging From the Photographs and Description as Given Herewith

By W. F. Sutherland

THE boring of a cylinder 10 ft. in diameter is not much of a trick, comparatively speaking, but it is sometimes a matter for speculation as to how some of the large cylinders, used in some of the earlier steamboats, were finished. Machine shop methods have improved wonderfully in even the last twenty years, and when the inadequate equipment available is considered, the achievements of the builders of the first steam engines are little short of marvellous.

No doubt the necessity for better methods of working and handling the raw materials used in the making of engines and other mechanical devices caused a development in the machine shop which went hand in hand with the engineering discoveries of Watt, Stephenson and others.

The engine lathe, in its essentials, the steam hammer and other mechanisms were all developed as necessity arose for better mechanical processes and the machines described herewith were designed for the boring of the large cylinders necessary in the earlier days when low steam pressures were much in evidence.

Messrs. Nasmyth, Gaskell & Co. were probably among the first to realize the advantages of vertical boring in the making of cylinders for steam engines, the freedom from distortion, due to the weight of the cylinder or boring bar being marked and one of the first machines designed by this firm is shown in Fig. 1. As is seen, the factory building in which the machine was placed formed an essential part of its structure and good use was made of the building walls, the whole outfit being tucked away in a corner.

The driving mechanism was entirely below ground level, a pit being provided for inspection and repair, stairs t providing means of access. Tight and loose pulleys, k, k, took power from the main shaft and transmitted it by means of the bevel gears, j j, to the shaft i, and the worm p to the worm wheel o and the boring bar. It will be noticed that the shaft i is not at right angles to the boring bar, but makes an angle with it of such magnitude that straight teeth could be used in the worm gear.

The vertical boring bar was made in two parts, the upper one, a, carrying the boring head or wheel r and the lower one connected to the driving apparatus. The upper part rested in a socket in the lower part as is shown in Fig. 3, and was fastened by a key or pin l. The boring bar was supported by a step bearing consisting of two hardened steel disks, submerged in lubricant in the cup shown. This cup in turn carried on its upper flange brass segments coned to fit the taper on the boring bar and provided with means for adjustment whereby the bar could always be centred and any play sideways taken up.

The upper end of the boring bar was carried by the cross-beam g, which was fitted to the sockets f built into the walls of the building. An additional stay was carried to the corner formed by the two walls.

Considerable ingenuity was displayed in the arrangement for feeding the boring cutter to the work and in provision for its lifting when a cut was finished. The boring wheel r was centred and driven by means of a sleeve m on the boring bar and by means of a nut l, which served both as a feed nut and key; the feed was regulated by the lead

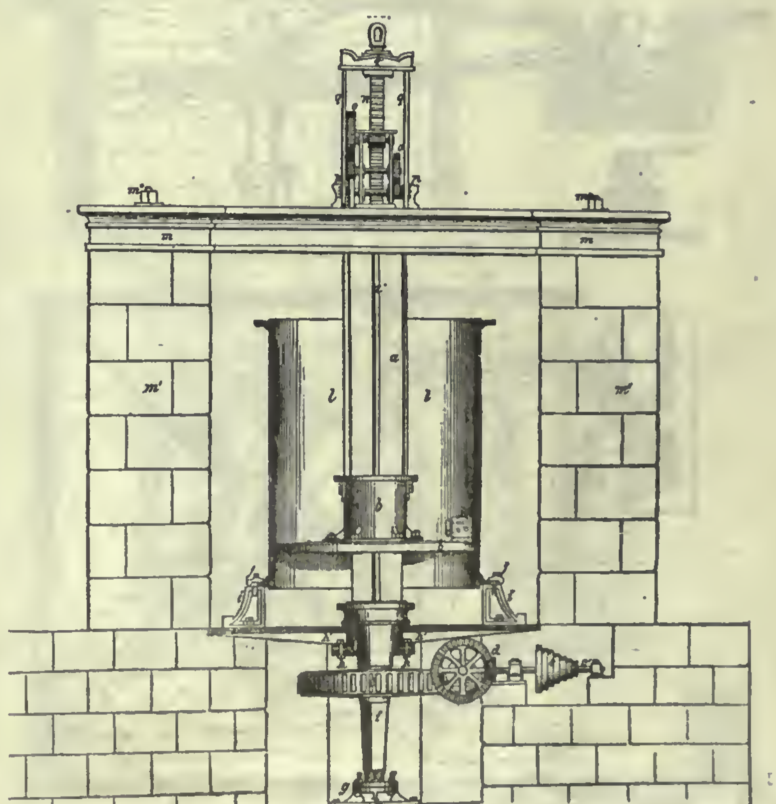


FIG. 4—A PECULIAR STYLE OF BORING MILL

screw shown. The lead screw was driven through the medium of a planetary gear transmission. When the cut was finished the boring wheel was raised by means of a winch shown in Fig. 2, the nut remaining on the lead screw and being afterwards raised.

Another machine of somewhat similar type and made by the same firm of engineers is shown in Fig. 4. The same arrangement of worm gear drive will be noticed, but the main lower boring bar bearing is placed above the worm gear. Coned plates are also fitted in this bearing, working on a tapered portion of the shaft as before. The upper bearing and feed mechanism are carried on massive masonry piers.

A keyway a' was cut in the boring bar and the two side slings, q q, carried the cutter head b and controlled its movement on the boring bar.

Feed Mechanism

These side slings were attached to a cross-head q at the top, which also carries the rack n. The whole of this upper machinery revolved with the boring bar with the exception of a ring at the bottom cut with an internal thread. A wheel working in the thread operated the gears and rack and thus lowered the cutter head as the work progressed.

Cylinders 10 ft. in diameter for the steamer Mammoth were bored on this machine.

Combined Machine

The next machine illustrated has several features of interest, three machines being combined in one for boring, drilling and face grinding. The Ionic order of architecture is also very much in evidence.

The centre machine was a boring machine used for boring large cylinders, the cylinder being not only held in place by the usual clamps at the bottom, but also by a sliding ring f. Fig. 5 carried on the centre columns and provided with adjustable clamps.

Motion was imparted to the boring bar by means of a vertical shaft and gear wheels, the proper feed being given to the cutter head by the rack and wheel k.

The second machine B, to the left, was a vertical boring mill of much smaller dimensions and was used for various boring and drilling operations.

The third machine, C, was used for the grinding up of the faces of piston rings, valves, etc.

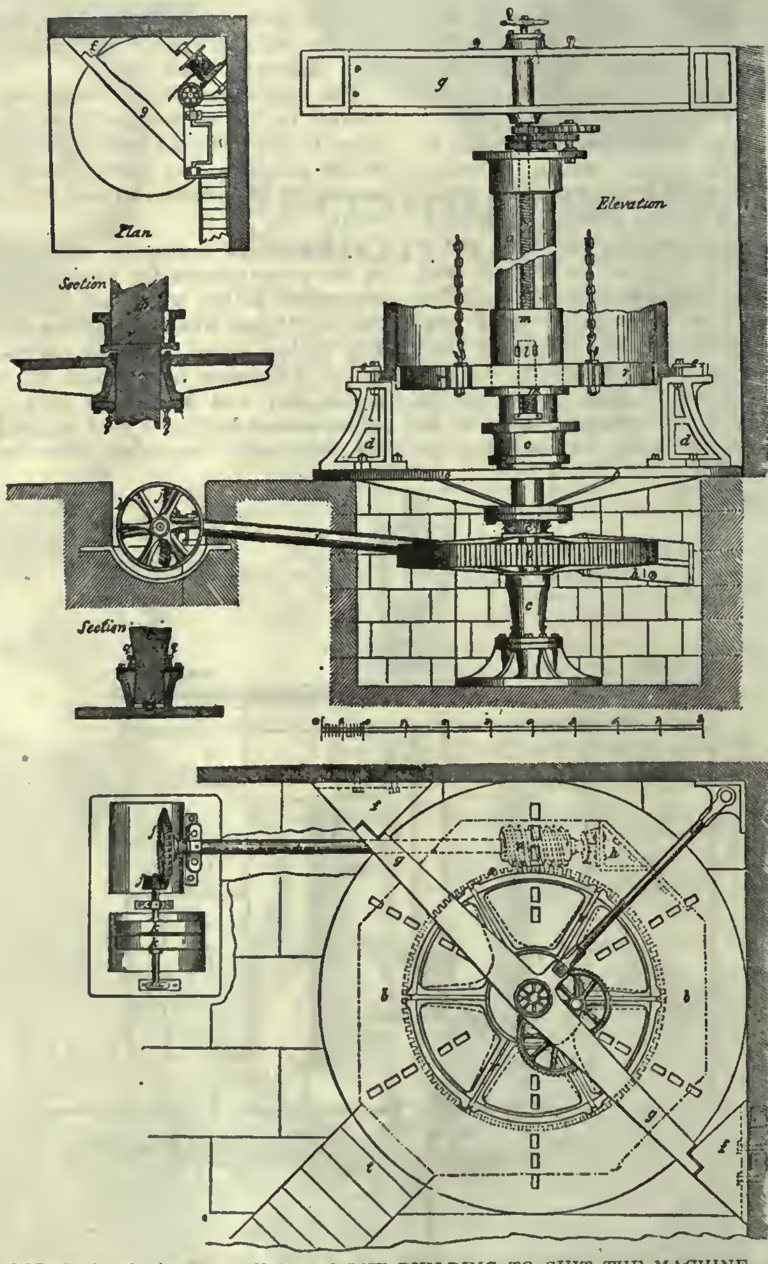


FIG. 1—AT BOTTOM. YOU MADE THE BUILDING TO SUIT THE MACHINE.
FIG. 2—UPPER LEFT. OTHER DETAILS.
FIG. 3—MIDDLE SECTION. ELEVATION OF MILL.

THE GUARDING OF MACHINERY

A recent article in Mechanical World, an English periodical, deals with the subject of proper safeguarding of machinery. As this is a subject of like importance on this side of the water, we reproduce this material for our readers' benefit. The author starts on the following manner:

It is the purpose of the writer in the few lines which follow to give free vent to opinion of theories and of facts regarding the problem of the effective guarding of machinery. The effective guarding of machinery will be clearly understood by those "close up" to the problem. For the sake of others equally interested and yet not so familiar such title may be more fully extended and its meaning rendered clearer and more convincing, as it meets the eye of the reader, thus: "The Effective Guarding of Mechanics and Operators From Injury by the Machines They Respectively Work and Operate."

The writer holds no brief for, nor cherishes an atom of sympathy with, proprietors and managers who, in a cold-blooded way, neglect all reasonable safeguards in respect of their workers, and neither does he hold a brief for those who would ignorantly and insensately enclose every piece of running gear in boxes of wood or iron, such enclosures rendering the machines they circumscribe commercially unproductive and comparatively valueless.

With the former class may be found the ignorant and the callous, but often less ignorant than callous; such men who buy a boiler and set it to work on their estate, not bothering a little anent its history and its present condition, and so long as it will, for a time, burn fuel, make steam, and drive their machinery. Then, if "the old trap" chooses to "go up" and kill a few people who have trusted the employer for their individual safety, "It is no affair of his," "Ordinary risk," "Unforeseen accident," "Regrettable circumstance," etc., etc., a Board of Trade inquiry, a few pounds fine, and he buys another boiler. There are a few wives widows, a greater number of children fatherless, and the world still revolves. No, the writer holds no brief for those but would punish each and every offender with the utmost rigor of the law, and if the law did not provide rigor sufficient, a law should be provided which did. Pro bono publico.

In the opposite class—those who would

cover every bit of moving machinery with a case—may be found various inspectors, doctors for insurance, and such like. There may be some of these officials who are experts and who are practical men, and who offer suggestions which are found to be practicable to follow, though the writer has been in charge of shops for nearly forty years without discovering one such. Those he has met and has come into close contact and conversation with have approached the shop foreman in a most objectionable manner. He (the inspector) has at times suggested that the shop foreman is a callous-minded being, "who would be much more careful in the guarding of machines under his charge if he had boys of his own." He, (the inspector), does not know, nor does he care to inquire respecting the fact that some of these "callous" foremen have boys of their own working machines, and that some of these foremen have preached the gospel of "effective guarding of machinery" years before they (some of the inspectors) were born.

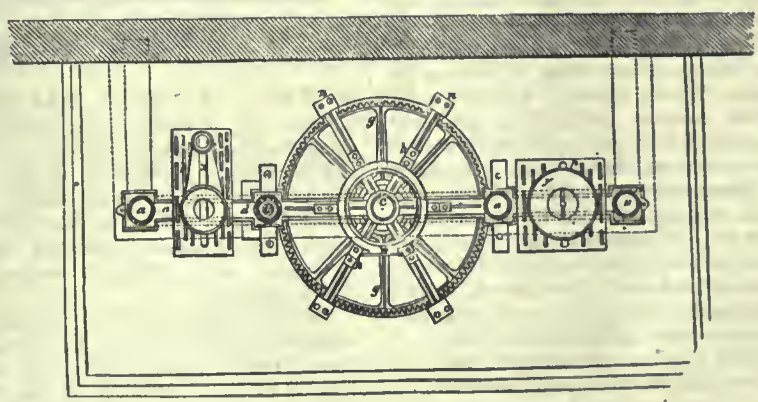
It is suggested, therefore, that with all due and proper respect and courtesy to inspectors of machinery, they should be advised to go warily, and, while doing their ostensible duty, not to inflict obvious plantitudes and time-worn arguments on attentive and considerate shop superintendents, who may have spent the greater part of their lives propounding schemes of safety for those under his or their charge.

All honor to the fearless inspector, who, when he comes across the callous man, "goes for him," and so would the writer. But if there is one position in this world where tact and discrimination is necessary for the successful discharge of such position, in the writer's opinion it is that of the factory inspector. He has the writer's sympathy, and hence these few lines on the subject of his work. Now, there is quite a boom just now in the home offices of the manufacturing countries in reference to the guarding of machinery. There is also a most pretentious "Safety First" association of Great Britain just now in the making. How many "bed-rock" shop men are on that committee, it would be fair to ask. All this is good, for it is admittedly high time that greater endeavor should be exerted for the purpose of lessening the number of casualties that result from the use of guarded and unguarded machinery.

The action of the Home Office inspectors, and, of course, the authorities above them, is highly commendable and salutary, and fully welcomed by foremen in charge of shops, but at the risk of being thought "speaking ill of dignitaries" the writer cannot help but offer a mild and friendly criticism of the plan of campaign and of the methods sometimes adopted by those esteemed officials.

There is another phase of the "guarding" problem. It is this. To legislate for it requires considerable discrimination. For example, take a large factory with hundreds of operators attending to or feeding machines. There are also hundreds of mechanics working machine tools. To get about such a factory and among the operators he would discover abundance of cases demanding his attention; in fact it would in many factories constitute a veritable "hunting ground" flagrant neglect of safeguarding. But, visiting a machine shop, it is suggested he goes stealthier, for the ground is more deilcate. Men who work these tools are mostly mechanics, skilled men, fully aware of dangerous "couples," and from early and subsequent habit and training they keep involuntarily and unconsciously and intuitively clear of such known and obvious danger, and they also know that the only way to remove that danger and similar dangers from many machine tools would be to box them up and keep the worker outside the box. Take, for instance, the cone belt of a 18-in. centre lathe of heavy build. Here we have a 5-in. wide two or three-ply canvas or leather belt, a belt of sufficient strength to smash up an elephant, and such a belt running at hundreds of feet per minute, the belt and the cone. This belt may be shifted on to the various steps of its cone twenty or thirty or more times a day, yet it is manipulated from one cone to another frequently with the bare hands of the turner, or, at best, with a hammer shaft or a piece of stick, and not once in thousands of changes does anything approaching an accident occur. But let such an operation of shifting such a belt be done by unskilled labor or by boys; they would certainly come to grief. So considerable discrimination is essential, nay more, is absolutely necessary when framing rules respecting the guarding of machinery, and this discrimination is demanded of Government inspectors. These inspectors, in the writer's opinion, do not seem equal to their job; they may be too high—even that is possible—but certainly not equal to it.

Real practical men—shop habitues for many years, trained to care for the safety of their comrades—should fill the position of shop inspectors primarily, and, after having done duty for a number of years in the shops it is suggested that from these the Government factory inspectors should be recruited. Better results, it is thought, would then accrue than the gathering up of inspectors among a number of applicants for the past, whose fluency in writing answers to stereotyped questions, may easily be in direct, yet adverse proportion to their familiarity with the problem of safeguarding mechanics and operators from damage by machinery.



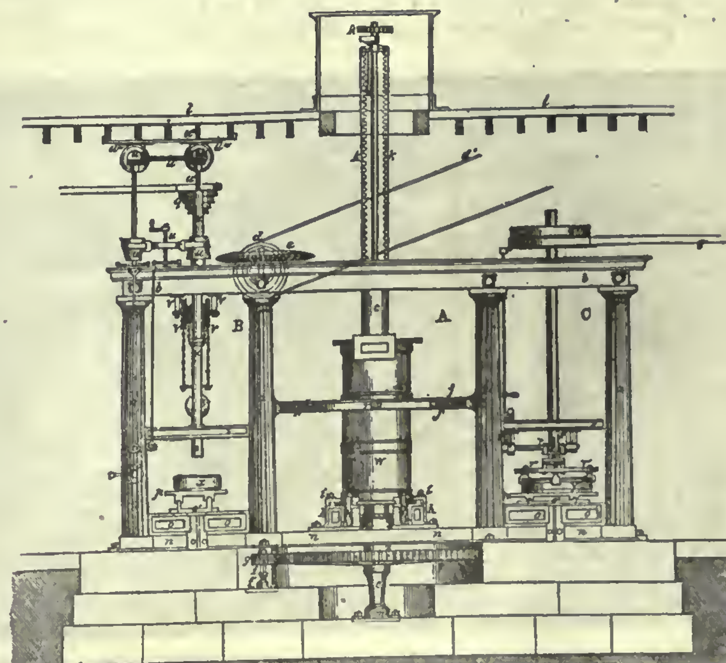


FIG. 5—A COMBINATION BORING MILL, DRILLING, AND FACE GRINDING MACHINE.

Have You an Efficient System of Packing?

If Not, Read This Article, and You May Find Some Hints Well Worth Following Out. The Company Whose System We Describe Have Studied the Packing Question Thoroughly

By J. H. Moore

SYSTEM, if properly applied, is one of the greatest assets we have in the industrial world. It is true that system can be carried to extremes, but immediately this condition arises, the name system is improperly applied and should be termed misapplied effort.

The International Harvester Co., Ltd., Hamilton, Canada, have been very careful to draw the distinction line between well-directed system, and wasted effort, with the result that their various operations are planned both systematically and intelligently. The human element has been carefully considered and the different tasks have been arranged in such a manner as to aid the workman in every way.

This viewpoint holds good in all departments throughout the plant, but in order to place before our readers some specific examples, let us consider two methods employed in the packing of some of their products.

FIG. 2—IN THIS CASE THE CORRECT NUMBER OF PIECES ONLY ARE PLACED IN THE DIFERENT COMPARTMENTS.

At Fig. 1 we show a workman preparing for shipment what is known as a Deering Mower Bundle. It is the policy of this concern to ship their products in standard boxes, packages, or bundles. Each department knows what is contained in these various bundles, and when the box, package, or bundle as the case may be is in assembled condition, it receives a special symbol number by which it is always ordered. Any agent, dealer, etc., can order from this number, knowing exactly what parts it will contain.

In order to eliminate error in packing, special trucks, benches, etc., are used to hold only such articles as go to make up the box or bundle. For example, let us consider the packing of the bundle shown at Fig. 1. A truck is used which is divided into certain compartments. In these various compartments are placed the parts used in making up the bundle. As a rule the workman makes up so many bundles from one loading of the truck. In the case illustrated the truck is loaded with sufficient material for thirty bundles.

The remaining task is simple. The workman merely takes a part from each compartment, consecutively. At the conclusion of thirty bundles he should have used up all his material, and in the event of his having some stock left over, or minus some necessary part, he knows he has made a mistake somewhere in the thirty bundles, and at once can check them over.

Apart from this checking feature, the systematic idea of having all parts within easy reach makes for added production with no lost motion. There is many a plant that could adopt this truck idea to good advantage.

FIG. I—PACKING A MOWER BUNDLE, USING A SPECIAL TRUCK AS AN AID TO SPEED.

Another Packing Scheme

Another system of a more elaborate nature is shown at Fig. 2. The work being accomplished in this instance is that of packing certain parts of a Deering New Ideal harvester. It might be well to first call attention to the style of packing crate used for this purpose. It will be noted that the sides, top and bottom, are of crated construction, spaces being left between the boards, only the ends being solid. The idea of this may not be apparent at first glance, but when we explain that they use the canvas (shown hanging out of crate at the first truck) for protection of the contents, one can readily grasp the idea. Considerable lumber is saved every year in this way, and the crate just as efficient in every respect.

This crate, when finally completed, contains quite a number of parts, so that a truck would hardly be practical for use in conjunction with its packing. A bench is therefore employed and is so arranged that starting at the one end the packer can pick up each part consecutively until the crate is finally completed. Only such parts are placed in this bench, or rack, as go to make up the crate. Immediately the packer has taken a

(Continued on page 589)

Crank Shaft Machine on Which Tools Revolve

The machine as illustrated is a very interesting machine, built by Hulse & Co., Limited, Salford, Manchester, for turning large crankshafts, and is of that type in which the shaft is held stationary while the cutting tools are caused to revolve around it. The machine comprises a slide bed 21 ft. 9 in. long, 8 ft. wide, and 18 in. deep, accurately planed and faced and having two longitudinal and numerous transverse box girders. On the bed is mounted a sliding carriage provided with a variable self-acting feed motion along the bed by means of rotating nuts and twin-feed screws, the nuts being fitted with ball thrust bearings.

The sliding carriage also has a quick power traverse motion and means for hand adjustment in either direction. The sliding headstock is built in two halves, and forms a housing for a revolving cast iron ring, which is caused to rotate in bearings inside the headstock by means of double helical gearing, the final drive being through a steel ring encircling the cast iron ring. A 30 horse-power electric variable-speed motor with double reduction helical gears provides the motive power, the motor being mounted on an entablature on the headstock, with which it can move. The motor has a speed variation of 3 to 1. On the front of the headstock are securely bolted two transverse slides, upon each of which is mounted a cast steel tool slide with variable self-acting feed motion to and from the centre.

The feed motion comprises two long cam surfaces bolted to and projecting from the front face of the headstock. Runners passing over these cam surfaces actuate the feed motion mechanism through a set of spur gears. The internal revolving body has an adjustable ring on the back to take up any lateral wear, and lubrication of the bearing surfaces is provided by means of an oil-box on the top of the headstock. The two short cutting tools are carried in slots in the steel slides, endwise adjustment being provided by means of adjustable screws, while the tools are securely held in place by means of two set-screws.

Both the feed and power traverse motions are controlled from one position, and the arrangement is such that it is impossible to engage the two motions simultaneously. This is brought about by the provision of interlocking levers. For securing the crankshaft firmly two supporting stays, adjustable along the bed by means of a rack and pinion, are employed, each fitted with clamps and bolts and swivelling brackets on the stays are provided to secure the crank webs in the necessary positions.

The machine is designed to deal with cranks up to 28 in. throw, and crankshaft and pins from 8 in. to 24 in. diameter. The height of the centres is 5 ft. 9 in.; the traverse of the headstock along the bed with both stays in position, 9 ft. 6 in.; the traverse adjustment, 2 ft. 6 in.; the range of speeds, 2.5 to 7.5 revolutions per minute; the range of feeds to the headstock along the bed, 1-4 in., 1-8 in., 1-16 in., and 1-32 in. per revolution of the tools; and the range of feeds to the tool slides, ⅛ in., 3-32 in., 1-16 in., and 1-32 in. per revolution of the tools. All the bearings for the quick running shafts are brass bushed, and the approximate total weight of the machine is 35 tons.

The United States Civil Service Commission announces examination by mail for assistant mechanical engineer at $1,680 a year, plus a temporary increase of $20 a month. The applicant must have graduated with a B.S. degree from an engineering course in a college or university of recognized standing and have had three months' experience in engineering requiring considerable computation work similar to that required by the duties of this position. Applicants should apply for form 1312, stating the title of the examination desired, to the Civil Service Commission at Washington, or the secretary of the U. S. Civil Service board at the nearest custom house.

The United States Civil Service Commission announces an examination by mail for metallurgist, at $3,600 to $4,000 a year. The applicant must have graduated in mining engineering or metallurgy from a college or university of recognized standing, and have had at least five years of responsible experience in such work. Applicants should apply for form 2118, stating the title of the examination desired, to the Civil Service Commission, Washington, or the secretary of the United States Civil Service Board at the nearest Customs House.

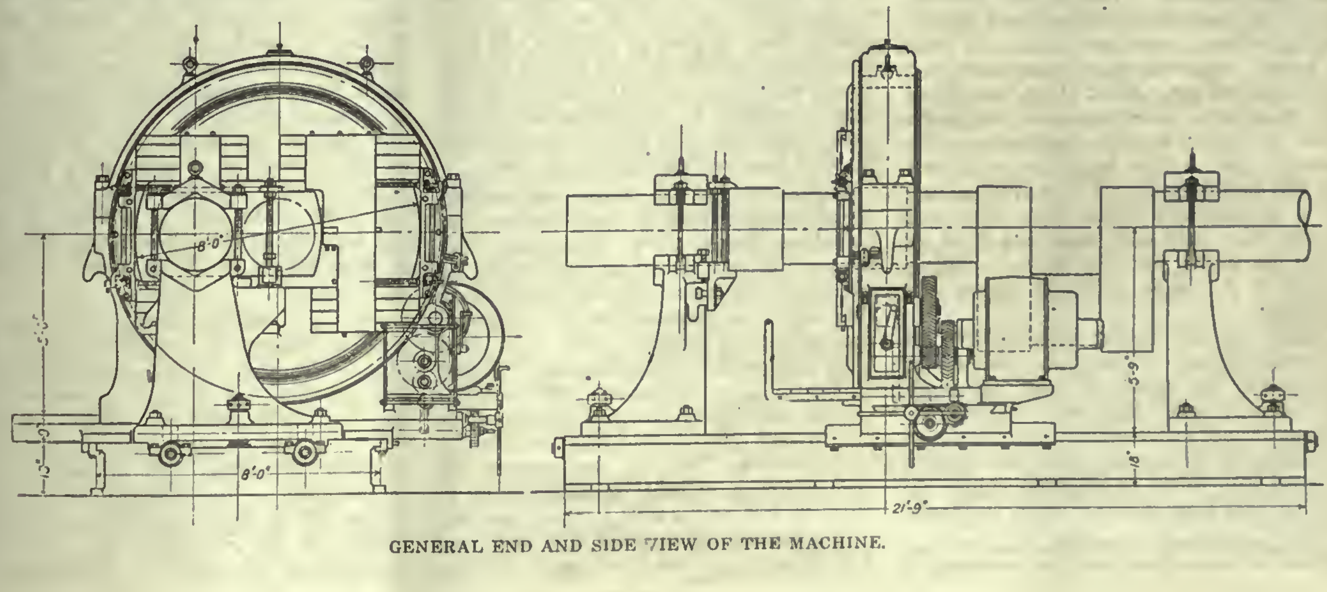
EFFICIENT SYSTEM OF PACKING

(Continued from page 588)

piece out of the rack, a workman on the other side places another similar part for the next workman. In this way there is no confusion, no delay, and the process of packing keeps on without interruption. The workman, whose duty is to replenish the packers rack, receives his parts from storage shelves at his side of the packing bench.

In our photograph we show only the finishing up the end of rack, but as the first portion is exactly similar in appearance we considered it much better to get a close up view of the arrangement. We call attention to the fact that at the end of a crate is shown the symbol number H7132F. This is, of course, the symbol number of the shipping package which we referred to earlier in our article.

We leave the subject at this point, believing that the two examples shown prove that systematic handling of any product is profitable and wise proposition.



GENERAL END AND SIDE VIEW OF THE MACHINE.

Recent Developments in Oxygen Cutting*

IN presenting the most recent developments in the art of cutting with oxygen we have concluded that the most interesting development which has occurred recently in connection with cutting is, without doubt, the successful cutting of cast iron.

More than a year or two ago, there were rumors heard now and then in the industry, of some genius who stated that he had cut, or could cut cast iron. These rumors were not given much credit cause it was thought that in most instances the man who believed he had cut cast iron had, in reality, cut something else which he thought was cast iron.

About this same time our Engineering Department began to think more deeply upon the subject, with a view to learning more of the basic principles underlying cutting, particularly with respect to cast iron. We began to experiment and detailed Mr. F. J. Napolitan to the work. He has continued hi efforts in this direction, until we believe he has developed some very interesting theories, and has evolved some principles which are of extreme importance to the art. In compiling this paper we have worked together to lay before the Society an outline of these theories and principles, which we believe will be of interest, and which may explain some of the conditions well known by men practised in cutting, but which had never been clearly understood by the majority of cutters.

When we succeeded in cutting cast iron, it must have disturbed our dignity in that we were obliged to reverse our former opinions and beliefs, and to take back the statement often made, that cast iron could not be cut with the oxy-acetylene torch. Unfortunately, our experiments are by no means concluded, so that we are not free to disclose all that we would desire. Frankly, our investigation of cast iron cutting was inspired by nothing more noble than to seek a better explanation of why cast iron could not be cut. Most of us, and I am no exception, have expressed at some time or other in our experience, the solemn opinion that cast iron could not be cut, because the oxide of iron melted at a temperature higher than cast iron itself. Not only does cast iron burn to form an oxide, but the higher melting point of the oxide probably assists the reaction.

While we are rather skeptical of the commercial value of the cast iron cutting torch, and are convinced that, financially, we will never be repaid for the expense of our experiments, yet there are undoubtedly occasions when the cutting of cast iron would be of great value. In the ordinary scrap-yard, or in instances where the cutting process would be used as with steel, it is so easy to break cast iron, that it would hardly be economic to use the cutting torch. Were we not to further develop cast iron cutting, however, we should feel remiss in the work of our Engineering and Research Department.

You are all aware, of course, of that application of oxygen cutting used largely in blast furnace practice, the opening of a "frozen" tap hole. You could not quite reconcile this more or less common application of the process with the pet theory that cast iron could not be cut.

One of the usual methods for releasing a frozen tap hole in a blast furnace, is substantially as follows: A piece of one-quarter inch iron pipe with a brass handle, at least ten feet long, is attached to a manifold of several oxygen cylinders. Oxygen is delivered through this pipe at a pressure of approximately 100 pounds per square inch. A hole is started with a star drill or diamond point, until it is just about thre inches deep. The metal adjacent the hole is heated with a fuel oil burner or by other means. The end of the iron pipe is ignited and the composite stream of molten iron slag and oxygen caused to impinge against the frozen cast iron.

A spectator to this performance of infernal fury, is readily convinced that the heat is not all due to the combustion of the wrought iron pipe, but that the cast iron is burning with a violence equal to that of steel. This reaction inspired some inventors to incorporate a device in an oxy-acetylene torch for cutting cast iron, which would feed a steel wire between the cutting jet and the cast iron piece being cut. Ignition of the wire carried a stream of molten slag on to the cast iron and it was hoped thus to propagate the cut. In a second process, a plate of steel of definite and predetermined thickness was placed on top of the cast iron. It was hoped that the slag incidental to the oxidation of the steel, would exercise some influence over the cast iron and enable it to be cut.

Unfortunately for those responsible for the exploitation of these devices, the inventors were more concerned with converting cast iron into iron oxide by means of the oxy-acetylene torch, than they were in constructing a practical process and a practical tool. It was next proposed to simplify the reaction by supplying an apparatus with a mixture of pulverized slag and iron powder, and in fact a number of patents were issued covering various applications of such a device. Crude and elementary as such devices were, they actually produced combustion of the cast iron and went a long way in stimulating us in our endeavors to find a successful method.

Experimental work was continued with a torch having a good many different tubes leading to the head, so that almost any combination of gases at varied pressures might be obtained. Mr. Napolitan has evolved from these experiments, interesting theories pertaining to the reactions which take place in cutting, together with their relation to our success in cutting cast iron. He has noted these theories in the article which follows. We are presenting these theories for what they are worth. We can actually cut cast iron and we do it by preheating the oxygen. We have endeavored to tell our conclusions pertaining to the reactions which take place. We will now take up the subject of metallography of iron and steel with reference to oxygen cutting.

Points Discovered

From the ease with which wrought iron is cut, we may conclude that an aggregate of ferrite combines with oxygen with greatest avidity, and permits the propagation of a cut with least interruption. As the carbon content is increased, there is a material change in the nature of the metal. In place of the preponderance of ferrite grains, we recognize the formation of cementite, and its union with some of the ferrite to form pearlite—the original mass of pro-eutectoid ferrite rapidly diminishing in prominence. As we should anticipate from the nature of pearlite, no material change is noticed in the performance of these alloys under the cutting torch. Of course, an ultra-precise consumption test would probably indicate a lowering of the efficiency coefficient, but from all appearances, no unusual difficulty is experienced in cutting carbon steels up to about 80 to 90 point carbon. But here, a definite transition is indicated by a distinct laboring of the cutting torch. While the torch will begin a cut with practically the same effort, and proceeds to completion without interruption or unusual delay, yet the kerf is wide and ragged and undeniably distinguished from that of a mild steel cut. It is recognized practice, now, to preheat the piece to be cut to a black or dull red heat, when the impediment, whatever it was, seems to have been entirely eliminated.

But let metallography explain the sudden change of properties of the steel. As the carbon content of the hyper-eutectic steel was increased, and the proximate mass of pearlite increased, and the pro-eutectoid ferrite correspondingly diminished in volume, until eventually, a point was reached where all of the cementite and ferrite existed in the stratified or laminated relationship of pearlite. This state is

*Paper read before the American Welding Society by Stuart Plumby and F. J. Napolitan.

recognized as existing where the carbon content is between 80 and 90 point—the approximate analysis of pearlite is yet undefined. As the carbon content is further increased, there appears a constituent that we know as pro-eutectoid cementite—in fancy, the cementite which has been ejected from the pearlite growth. It is circumstantial that the presence of this pro-eutectoid cementite is directly responsible for the increasing difficulty of our cutting. But why did preheating of the steel before cutting make such a remarkable difference in the results? To be sure, the rise in temperature might affect the stability of any martensite, trootstite, or even sorbite, that might have existed, but the temperature was too far removed from the Ac_{321} point to affect the characteristics of the pearlite. And surely the pro-eutectoid cementite was unchanged—and it was this same constituent that we blamed for the difficulty.

Again, as the carbon content is substantially increased, an equivalent interference with cutting is apparent, until, when the carbon content approaches 2.5 per cent., cutting becomes so labored as practically to cease, and no amount of preheating short of incipient fusion will permit it to propagate. As you are aware the metal is now termed "cast iron," and a micro-analysis indicates that in addition to the presence of a certain amount of pearlite and pro-eutectoid cementite, as well as certain foreign and to our discussion, unobtrusive substances, we recognize the presence of the final and most stable state of carbon—graphite. The pearlite constituent exercises a favorable influence upon the operation of cutting—and the pro-eutectoid cementite, while it impedes cutting, is readily compensated by a slight preheating—but the graphite presents an entirely new problem.

We might digress from the subject enough to present some remarks that would prove the fallacy of at least one of the stereotyped explanations of why cast iron cannot be cut—that the melting point of the slag is appreciably higher than the melting point of cast iron. A micro-analysis of the structure of an average cast iron—and by average we refer to a gray cast iron of about three to four per cent. carbon—would indicate a structure identical with that of a hypothetical steel of the same carbon content, except that some of the carbon sems to have been precipitated as graphite. But should that identical pour of cast iron have been cast against a cold iron mold, or otherwise chilled, the carbon would not have been precipitated as graphite and we should have had what we shall call a "chilled cast iron," or a "white cast iron,"—and it would actually have been a hyper-eutectic steel. Such alloys are not uncommon in commerce, and the fact that operators have been able to cut them with no extraordinary effort, has been responsible for innumerable false claims that cast iron has been cut. Unfortunately, the nomenclature of steels and irons is not clearly defined, and undoubtedly, a chilled cast iron is but an extension of the hyper-eutectic series. The melting point of an iron-carbon alloy is a constant of its composition, whether, in the solid state, the metal exists as a typical cast iron or as a steel. Long before the point of fusion, the carbon and the iron exist in one relationship, that of austenite. The conditions affecting the pouring of a melt of cast iron would determine the final state of its constituents—and we might as readily produce a gray cast iron or a chilled white cast iron—the carbon as graphite or the carbon as in cementite. In either event, the melting points of the resulting products would be identical. We agree that chilled cast iron can be cut with comparative ease, notwithstanding that its melting point is lower than the melting point of the slag produced. It is evident, then, that the melting point of slag is not respon[illegible] for the difficulty encountered in cutting cast iron.

We had concluded that while the existence of pro-eutectoid cementite appreciably retarded cutting, the presence of but a comparatively small amount of graphite completely prevented cutting. The phenomenon, if it were true, is unique, for it would pre-suppose the incombustibility of carbon. Science contradicts us immediately. In fact, our own welding practice belies us. We might point to the reaction accompanying the removal of carbon from automotive cylinders by the oxygen method —or, leaving our immediate field, we might mention the explosive combustion of carbon in ordinary gun-powder. We are forced to conclude then, that far from retarding the combustion of the steel matrix, the graphite of cast iron should actually assist it.

We investigated further to determine how much graphite influenced cutting. We obtained specimens of so-called malleable castings of the characteristic "black heart" structure. Such a structure is made in this country by the annealing of white cast iron in which all of the carbon exists in cementite or pearlite, the latter in some cases entirely removed. The treatment decomposes the cementite to precipitate the carbon in minute particles, differing from the graphite of gray cast iron in their extreme subdivision and uniform distribution throughout a ferrite matrix. In making a black heart casting, an oxidizing package is used in this country, so that while the core is that of a black heart casting, the mass near to the surface is ferrite. We removed this shell of ferrite so that our materials indicated, under the microscope, a uniform aggregate of ferrite and temper carbon. By preheating this piece to a dull red heat, it was cut with the characteristics of a high carbon steel. Then we were satisfied that carbon as such did not prevent cutting, but that the physical state of that carbon was responsible. As plates of graphite, cutting was prevented—but as finely divided particles, cutting was scarcely impeded.

Reconsidering our previous observations in the light of this development, we began to substantiate our first logical hypothesis. We found, to summarize, that ferrite permitted most readily to be cut. Pearlite with pro-eutectoid ferrite did not materially affect the conditions. A completely eutectic composition first suggested a transitory stage. The existence of pro-eutectoid cementite retarded cutting but preheating of the piece to a red heat readjusted the conditions so that cutting was again as efficient as in the case of ferrite. As the comparatively low temperature produced by preheating was insufficient to affect any change in the physical state of the constituents of the alloy, we were forced to conclude that the addition of heat units affected a definite constant, which we assumed was the heat of combustion of the iron, as the two forces were of like characteristics. Then a constant result from a variable, made axiomatic the existence of a second variable. Our second variable, then, we concluded, was the cooling effect of the stream of cutting oxygen, and a further thought suggested a third variable in the time of chemical reaction between the iron and oxygen. The preheating flames ignited the steel —the cutting oxygen produced combustion—and the propagation of the cut was a natural consequence. But as the carbon content was increased, the speed of the reaction was materially lowered; however, the velocity of cutting oxygen to insure a continuity of oxygen and slag to the bottom of the cut, was a constant. Then, eventually, a point was reached where the rate of combustion between the iron and oxygen was so slow that the heat units liberated from the reaction were dissipated to such an extent as no longer to ignite adjacent masses of metal—and cutting ceased. By preheating the piece before cutting, we add to the forces on the weakening side of the equilibrium, and cutting once more obtained. The heat units so obtained, compensated for the relatively less heat units liberated from the chemical combination of the iron and oxygen in a definite unit of time.

While the pearlite and pro-eutectoid cementite are readily compensated, the graphite carbon effectively prevents cutting by the ordinary means. No addition of heat units short of incipient fusion, by preheating the object, restores the equilibrium. We cannot strengthen further one side of our equilibrium, but we have not attempted to affect the other side. We have made no attempt to reduce the cooling effect of the cutting oxygen. We therefore experimented in this direction, and found that we could so effectively preheat the cutting oxygen that we could restore the equilibrium without preheating the object.

Operating a Machine is Not as Easy as It Looks

At Least, So John Conley Says. He Has Now Been Promoted to Drill Hand and Learns Some Valuable Hints From Both the Foreman and His Own Father

By J. Davies

"WHEN I walked through the shop this morning, John, I noticed you were working at a small drilling machine. Have you been promoted?" "Why, yes, Dad, I have been trying to run that machine for six weeks now." "How are you getting along with it?" "Sometimes I think I am getting along fine, then at other times I wish such a thing as a drilling machine had never been invented. I used to think any fool could run a drill." "I see you found out one fool that couldn't. Well, let me hear some of your experiences, perhaps I may be able to help you."

"Well, father, the first job I had, was to drill some small holes in a number of pieces of flat iron, and everything went along fine for a while. It was a pleasure to see the cuttings come curling out of the hole. The machine was running at a pretty fast clip too. I left it for a while to go and get a drink of water; when I came back I couldn't get the drill to cut at all. Of course the men working nearest to me made some kindly suggestions. One said I was feeding too fast, another said to put some soapy water on the job, another said to put some clagem on the belt. I tried all these suggestions but they were of no use, the drill would not cut, so I had to go and get the foreman. As soon as he neared my machine he gave me one look and said, 'Don't you see the drill is running backwards?" I explained shamefacedly that someone must have changed the direction of the drill while I was getting a drink of water."

"'I suppose you left the machine running,' he said. 'That is why you didn't notice the change when you came back. Whenever you find it necessary to leave your machine for any purpose, always stop it.'

"I got started off again and everything went smoothly until the drill had to be sharpened, then I certainly had a time of it. It was no good getting someone else to sharpen it, for I had to learn to do it myself. I guess I sharpened that drill half a dozen times before I could make it cut, but at last I got it cutting fairly well. I had lost a great deal of time, so I thought I would make up for it by holding some of the pieces in my hand instead of bolting them down to the table as I had been doing. I managed the first one and second alright, then the drill snatched the third one out of my hand and whirled it around on the table, knocking the oil can, my rule, and a few bolts and nuts off the table. It also hit me a whack in the stomach and broke the drill.

"The foreman walked up just at that moment. He has a habit of turning up just when you don't want him, but when everything is going fine I never see him around. I expected he was going to sympathize with me, but instead, he coolly picked up one of the pieces I had just drilled, examined it critically, and said, 'John, you are making those holes too big.'

"At this I got hot under the collar and asked him how in the world I could make the holes too big when I was using the same drill he gave me at first; then he gave me a clipping that he had cut out of Canadian Machinery and asked me to study when I had time. Here it is and this is what it said:

"'There are at least seven wrong ways of grinding a drill to say nothing of a few original methods of every apprentice: (1) too flat; (2) too sharp; (3) unequal cutting edges; (4) unequal angles; (5) no lip clearance; (6) too much lip clearance (7) unequal lip clearance.

1. The result of grinding too flat forms a hook-like cutting edge and it is very hard to get a round hole. The drill ground in this manner is very apt to get away from the centre punch mark, and must be watched very closely.

2. Too sharp a point puts unnecessary strain upon the machine and if you happen to be drilling thin plates, the drill points come through the plate before the full size of the drill is entered into the metal, this allows the drill to wobble all over the job and causes a very irregular shaped hole.

3. Unequal lengths of the cutting edge form a serious defect as this results in the hole being too large, although sometimes the fact of a drill possessing equal angles and one cutting edge longer than the other, can be turned to advantage, as in a case where you want a hole just a shade larger than the drill, or between the sizes of standard drills, otherwise, as it often happens, especially in a small shop, you will have to use a drill with the margin considerably worn. Wear on the margin or land leaves the drill without sufficient clearance, so that it is apt to bind in the hole, and also drill a little small. In a case of this kind it is a distinct advantage to grind one cutting edge longer than the other.

4. If the point of the drill is in the centre but the angles of the cutting edge different, all the work will be done by one cutting edge, and the drill will be crowded over to one side, which has a tendency to bind the drill, also make the hole too large.

When both the angle and the length of cutting edges are wrong it is impossible for the drill to give anything like satisfaction, it will be working under very bad conditions. The support which a properly ground drill receives from the metal being drilled is entirely lacking.

5. If the drill has no clearance it simply will not cut and any attempt to make it cut by force will only end in disaster, usually splitting the drill up the web. On the other hand if the drill has too much clearance it is liable to dig into the work and becomes loose in the drill socket. If you are using a straight shank drill, it would most likely slip around in the drill chuck and the edges also will keep breaking away because there is not sufficient metal behind them to support the edge.

As the drill becomes shorter, the centre becomes thicker, because the web of the drill is made thicker towards the shank to give it strength. To overcome this, thin the edges, taking care to keep the point central. The three main features to aim at in grinding drills are: (1) equal lengths; (2) equal angles; (3) proper clearance. The angle recommended by most makers is 59 degrees on each side.

After I had studied that clipping I found out the reason I had been making the holes too big. I had been grinding the drill with unequal lengths of the cutting edge.'

"After this I had an interesting experience drilling some very deep holes in some cast iron blocks. I would drill for a little while, then the drill would choke up and I tried to blow the cuttings out of the hole. I blew them out alright, but they went right into my eyes and mouth and made me look like a nigger, so I quit that method and tried poking them out with a stick, then I got a good idea from Jim Walker. He told me to get an old round file small enough to go in the hole and take it over to the boss electrician and get it magnetized. This worked fine,—when the drill choked again I just poked it into the hole and it came out loaded. I could clean out the deepest hole in no time, but I had some trouble in drilling holes deep enough. The standard drill was too short, it scarcely left any hold in the chuck, so I consulted one of the old drill hands and asked him the best thing to do.

"He said, most people use an extension drill, that is a special long drill, but a much cheaper and a very useful tool to make was to make a holder of my own, which I could use with the ordinary standard drill. This is how he said to make it. Take a piece of cold rolled steel long enough to give a good grip in the chuck, drill a hole in the end the size of the drill we wish to extend, then file or shape a slot at the end of the drilled hole to fit a flat surface that has been filed on the end of the drill. Here is a little sketch he made for me. He helped me to make one, and it worked fine."

"That's right, John," remarked the father, "never be afraid to ask questions and never pretend you understand anything if you don't. If anyone wants to tell you how to do a job, listen respectfully, then use your own judgment. When that piece of iron hit you a rap in the ribs it would appeal to you with some force that whatever piece of work you are operating on it needs to be made secure.

"Apprentices as a rule, are careless in this respect; they often try to hold the job with their hands, thinking it too much trouble to hunt for bolts, etc., to make the job secure. This is the cause of broken drills, and often of more serious accidents. You will have to learn to use your own judgment in this respect, as every job must be handled on its own merits, but it is better to err on the safe side.

"Some jobs, such as rough holes in a flat bar, need not be bolted down. Put the job on a piece of wood of even thickness, hardwood preferred. Then fix a bolt with piece of pipe on it in one of the slots of the table, which will form a good stop for all jobs of that description. For jobs that need to be bolted down, the common U-clamp is the most convenient. This consists simply of a piece of square iron bent to leave a slot in which the bolt fits easily. Sometimes in places where the nut would be in the way, it is convenient to have a set in it.

"In bolting work of any description to the drill table, see that there is room under your job for the drill to go clear through without making a hole in the table. It may be necessary to put parallel pieces or other packing under the job. Have your bolt or bolts as near the job as possible, and your packing piece as far away as is convenient, and your packing pieces the same height.

"In such a simple operation as bolting a piece of work to the table of a machine (this applies to other machines as well as the drill), there is a principle involved, which if you keep in mind it will help you in many ways.

First, never place your packing too low, for if you do you will not grip your work properly. Another thing to watch is that you do not use a clamp that is too thin. Thin clamps always bend and spring, therefore not holding as they should. The third thing to watch is that you get the bolt at the right end. You may say, "What do you mean, right end?" but here is what I refer to. Suppose you get your bolt away out from the work, and practically up against the packing, what happens? Simply this, that you are actually clamping your packing and not your work. The correct position for your holding down bolt is as near the work as practical, and as far away from the packing piece as possible. This is the true secret of proper and secure holding, but enough for this time, we'll continue our talk at some later date.

The Carbon Contained in Different Types of Steels

By W. S. STANDIFORD

ONE of the most important subjects in the manufacture of metal goods, is the amount of carbon content that tool steel contains. This element has a great influence on the hardness that the cutting edge will hold, which is a most important point in the rapid production of articles.

High-speed steel containing little carbon is not used as extensively as it should be for machining work. The average machine shop foreman has a very hazy idea regarding the part that carbon content plays in the machining. In many cases he uses a steel for working hard castings that is too low in carbon content; the result being that the workman has to waste a great deal of time regrinding the tool. In order to do any cutting at all, the tool has to be harder than the metal cut; and the harder it is, the longer it keeps a keen cutting edge, thus enabling a large amount of work to be done before it needs regrinding. It is characteristic of steel that the harder it is, the more brittle it becomes, so that for manufacturing purposes, it has to be tempered, which process renders it slightly softer but tougher, thus enabling the metal to withstand shocks and strains much better.

To enable any foreman to select steel having the right amount of carbon for different classes of work, the writer appends a list which will be found, by experience, to give good satisfaction for use in making various tools as indicated. Manufacturers who use a great variety of tools will find it advantageous to keep on hand a stock of steel containing different percentages of carbon. This allows greater flexibility in the tempering process, allowing for tools to be made to suit various requirements of work. Thus a high carbon steel crowbar of 1.50 per cent. carbon, no matter how carefully it is tempered, would be brittle compared to a crow-bar made of .80 per cent. carbon, the latter being able to withstand far better the rough usage which this class of instrument generally receives. All tools requiring a fine cutting edge for finishing work, such as lathe tools, milling cutters, taps, razors, needles, etc., for fine dies where sharp outlines and great endurance are required, and for fine springs, saws and kindred uses, are generally made out of crucible, or a steel made in the electric furnace, the latter giving a very superior product.

Carbon Contents of Steel for Tool Making

.50 per cent. carbon is best for battering tools.

.70 per. cent. carbon is used for hot work and dull edge tools.

.80 per cent carbon should be used for wood cutting chisels and some forms of reamers and taps.

.90 per cent. carbon steel is used for making cold chisels, drills, taps, dies, etc.

1.00 to 1.10 per cent. carbon steel is used for lathe tools, axes, hatchets, knives and also large lathe tools.

1.50 per cent. carbon is used for roll turning lathe tools, graving tools, scribers, scrapers and small drills.

The best all-around steel is that between .90 and 1.10 per cent. carbon. For many purposes, especially in rolling mill work where large shapes or sections have to be turned; it is customary, in order to save expense, to have the cutting edges made out of a piece of steel which is welded to the top edge of an iron bar. This gives good service in turning rolls if the welding is properly done by the blacksmiths. In the welding of a high-carbon steel bar to an iron one, it has been found out by experience that steels containing a large amount of carbon are difficult to weld, the classification being about as follows: 1.50 per cent. carbon welds with difficulty. 1.10 to .90 per cent. of carbon welds fairly. .80 per cent. carbon and lower percentages weld easily. Steel containing .15 per cent. carbon is generally used as a substitute for iron and it will not temper. It will readily be seen from the foregoing, that in order to make steel that will take a keen cutting edge—it is necessary for it to contain a sufficient amount of carbon; as the latter is the hardening agent. Tools for the turning of rolls used in steel works, which are made out of cast iron, chilled iron, semi-steel, steel and alloy-steel rolls containing manganese, are usually too hard to be turned with a tempered tool such as is used on an engine lathe by machinists; but have to be left as hard as fire and water can make them in order to do any cutting at all.

All steel tools that require tempering have to be hardened first. This is done in many ways, the tool being turned over from time to time, until it is evenly heated to a cherry-red color. It is then plunged into either a solution of plain water, salt water, or a solution of cyanide of potash in water, according to the preference of the temperer. The cyanide and salt water solutions make a tool very hard. When used to turn rolls, no drawing of the temper needs to be done, the metal being ready for use if it has been previously ground. In tempering machinists' lathe tools, etc., the method adopted by good blacksmiths is to first harden the metal in the manner previously described, with the exception of not plunging all parts of the tool in the hardening solution; but leaving some heat in its shank, while the cutting

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WHAT OUR READERS THINK AND DO

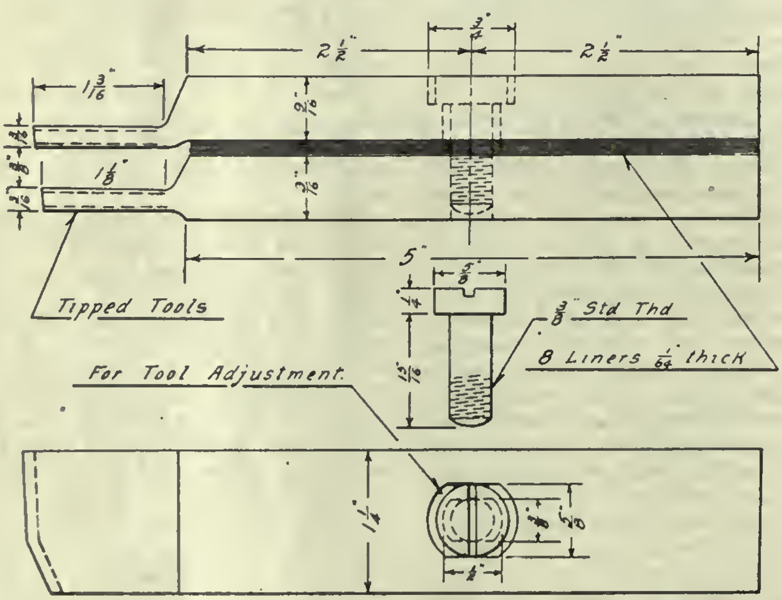
DOUBLE PARTING TOOL

By Clyde D. Thorburn

The tool as shown is one that we have used with considerable success in parting off piston rings from sleeve castings. This tool is adjustable, which makes it doubly useful and we also have a gang tool of four cutters which works admirably when soft grey iron castings are given us by foundry. Frequently the castings are extremely hard and on these we are unable to use the gang tool economically, as both feed and speed have to be reduced, and under these conditions the life of the gang tool was very short.

The tool, as illustrated, is merely two parting tools, mild steel body, with high speed tips, one drilled and counterbored and one drilled and tapped to take the cheese head screws for holding the two tools together. Between the tools are eight liners, each 1/64 in., to allow for adjustment when tools are worn and ground. Using this tool we were able to maintain the same R.P.M. and feed speed as when only using one tool, therefore practically doubling the number of rings cut off.

The upkeep is very small in comparison to the four cutter gang tool, as all that is necessary is renewal of tips when worn. It is important that the top tool has the required amount of lead, and the cutting faces of both tools so ground that the top edge of each tool will cut through before the bottom edge.



GENERAL VIEW OF THE HOLDER.

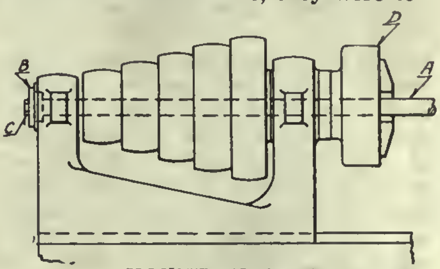
HOLDING A LONG SHAFT TRUE IN A LATHE

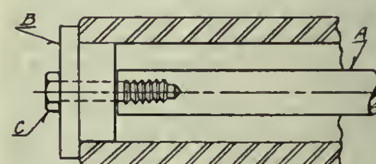
By F. Scriber

Having a number of shafts with a tapped hole in the end to machine and these being longer than would go between centres of the lathe, they were to be machined on, recourse was had to the method shown by Fig. 1 for holding them true. The hole was first drilled and tapped, using a back rest on the lathe bed and holding the drill and tap in the tailstock by passing the work through the hole in the headstock spindle and driving with a chuck in the usual manner, following which the shafts were reversed end for end and again passed through the headstock spindle as shown at "A," Fig. 1.

In this position a bushing "B," which fits the inside diameter of the spindle is fastened to the end of the shaft by screw "C." The chuck "D" is then tightened, thus the shaft is held true at the tapped end by the bushing; it is trued up at the chuck and the back rest holds the outer end while that end is machined. The bushing "B" also locates each shaft in the same position endwise.

An enlarged view of the bushing and spindle end showing the screw holding the shaft is illustrated by Fig. 2. The particular advantage in holding by this method consists of having the tapped holes true with the turned end.





ILLUSTRATING THE METHOD OF HOLDING SHAFT TRUE.

MARKING NAMES ON TOOLS

By W. S. Standiford

Many mechanics like to have their names or initials put upon their tools. This is generally done by means of a steel stamp containing the desired letters, but as marking the name by use of a stamp requires considerable force in order to do the work properly upon the unhardened part, it frequently happens that they are thrown out of adjustment by being sprung or bent, which interferes with their accuracy and often renders them useless.

The steel stamp cannot be used upon hardened parts at all, thus some articles such as hardened steel rules must remain unmarked. The acid process of etching names has the advantage that it does not throw any parts out of alignment, and also allows hardened or soft sections to be eaten away by the acids, so that a workman can place his name upon the metal wherever he likes. By using the first chemical method which makes copper colored letters, or if a set of rubber type is used with asphaltum varnish, it will be found by experience that the corrodent employed makes a much neater appearing piece of work as contrasted with the sulphuric acid mixture given in the last recipe. Both are good though, and do the work well, but the writer regards the copper formula as producing the most artistic work. Formula for a copper corrodent is as follows:

Distilled water	4 ounces
Copper sulphate	1 ounce
Salt	1 ounce
Zinc sulphate	½ ounce
Alum sulphate	¼ ounce

Mix all the chemicals in the water and shake vigorously until they are dissolved. The mixture is then ready for use. Now take the articles to be marked; clean off any rust on the article with fine sand or emery paper on the spot where the name is to be placed. Smear it with good soap or paraffine wax, then write name down with a scriber, or other sharp instrument, and cover the marking with the fluid—or better still, fill up the tracing with it. Leave the object alone until the name turns copper colored. Moisten the soap with water, or if the wax is used, scrape it off. The soap can be removed easily by rubbing. The solution need only be left on for five minutes.

To those who would like to have their names put on tools in a neater manner than is possible by using a scriber, the employment of rubber type, which can be bought at any ten cent store, is recommended. In using the type, proceed as follows: Set type in the holder in a reverse direction to what it will appear when printed; or in other words, reading from right to left. Get a small can of asphaltum varnish from a hardware store, tack a piece of cotton cloth to a piece of level wood, spread a small amount of the varnish by means of a flat stick on the cloth; press the type on the cloth, then press type lightly on the metal and let it dry, which will take only a few minutes. Make a small rectangular piece of wood about ⅜ of an inch thick, the length and width depending upon the size of tool and length of name; the object being to have as wide margin as possible around the name.

Bevel the sides of the rectangular piece of wood with a knife or file—a steep angle making it withdraw easily from the soap. Put a tack in the middle of wooden piece to serve as a handle, lay the rectangular section of wood over the name, making sure that the margins are equally spaced. Then put soap or wax around the sides of wood so that none of the solution will escape. Withdraw the block, and fill the place with corrodent. Pour the latter off after it has been on five minutes, and clear away soap or wax as previously described and you will have your name in black letters on a copper colored background. The type should be cleaned with turpentine after using. In inking the type with asphaltum, care must be taken not to get too much on as it will clog the letters; if they should contain too much ink, it can be gotten rid of by pressing it on a piece of paper. It would be better for the beginner to try the process on a piece of iron or steel before putting his name on the tool; thus he will get familiar in handling the type and do a good job. These directions for doing the work may seem tedious, but it will be found in practice, that it is a very easy matter to place names upon tools.

Another method of etching names on steel, is by the use of sulphuric acid solution. This cuts directly into the metal and leaves the letters countersunk, both background and letters having the same color. If the rubber stamp letters are used with asphaltum varnish, the background will be eaten away, leaving the letters in relief. The acid mixture is made as follows:

Sulphuric acid	1 ounce
Water	4 ounces

Pour the acid slowly into the water, stirring with a stick—don't add the water to acid as it will fly up into the face. After making, use soap or paraffine wax to cover the parts of tool as previously described, using a scriber to scratch through soap or wax to enable acid penetration. After the work is done, wash off acid thoroughly and grease article to avoid rust. It should be remembered that both etching mixtures are poisons, and the hands should be cleaned after the work is done.

DRILL JIG FOR TWO PARTS

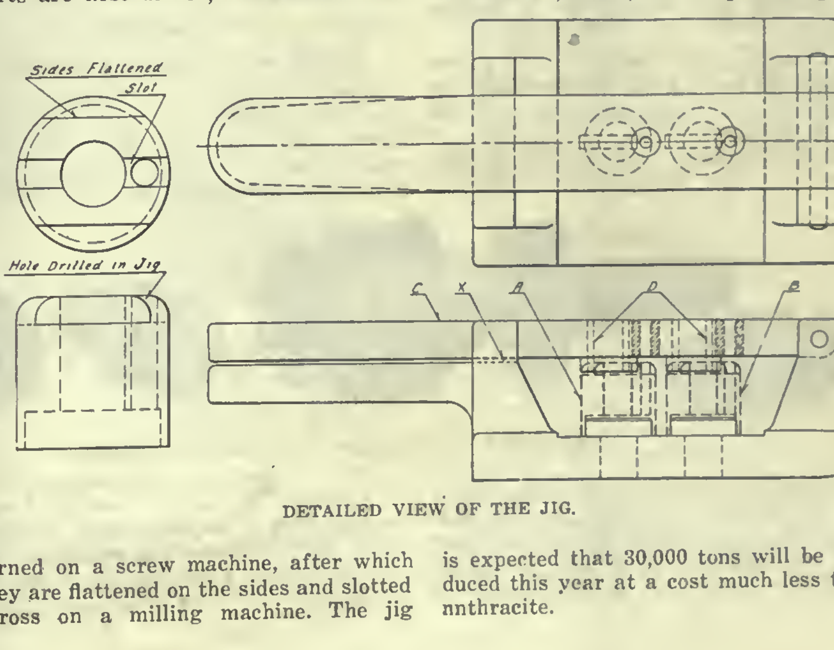
By F. Scriber

It quite frequently happens when small parts are to be drilled that a jig is made, which although it locates the work properly, it is in turn very hard to hold, owing to it being so small that it is carried round by the drill as it is fed into the work.

With this in view, the jig illustrated by Fig 1 was designed for holding two parts such as are shown in Fig 2. These parts are first drilled, counterbored and turned on a screw machine, after which they are flattened on the sides and slotted across on a milling machine. The jig shown is for drilling the small hole at the side.

Referring to the jig drawing, Fig. 1, two parts, A and B, are slipped over pins, the cover C with a handle formed on the end of it carries two pins D, which are flatted to go into the slots of the work, thereby locating the same radially. The cover swings down against the seat X, and in this position there is about .010 clearance between the work and the cover, consequently the work is not gripped in any manner, but is held in a fixed location from which it cannot get away, the cover being held down and the jig held by one hand while the drill spindle is operated with the other hand.

This makes a very quick and efficient jig, is easily held by the operator, and he is not apt to be cut by revolving sharp edges.



DETAILED VIEW OF THE JIG.

INTERESTING BOOKLET

A very interesting booklet has been prepared by the Warner & Swasey Co., Cleveland, Ohio, to record the celebration of their fortieth anniversary. This book presents in brief form the history and development and character of their business, and has been prepared, not only for distribution to the members and employees of the firm, but to any others who may be interested.

NEW CATALOGUE

The Butterfield & Company division, manufacturers of taps, dies, screw plates, blacksmith stocks and dies, tap wrenches and reamers, etc., have issued a new catalogue known as No. 18. In addition to the various lines illustrated, a section is devoted to tables and general information, all of which are useful at any time.

Producing Lignite.—By the first of August the lignite briqueting plants established by the Research Council to fit for use the coals obtained at Souris and at Estevan, Sask., will be producing. It is expected that 30,000 tons will be produced this year at a cost much less than anthracite.

DEVELOPMENTS IN SHOP EQUIPMENT

FRICTION CHUCK

The Roberts Manufacturing Co., New Haven, Conn., have placed on the market what is known as their Improved Friction Chuck. This chuch is especially adaptable for drilling, tapping, and stud setting, and its positive friction prevents the breaking of taps.

The first illustration shows the differerent parts disassembled, while the second photo shows the different attachments In assembly condition.

The design of this chuck has been carefully prepared, and the number of working parts reduced to a minimum. All set screws and feathers have been eliminated, which enables the operator to handle the chuck with perfect ease.

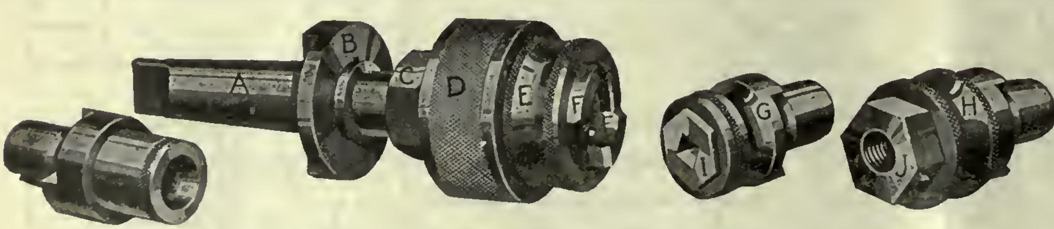
The friction is metal to metal, no fibre washers being used. This ensures positive friction, with no accompanying trouble or annoyance. The nose piece, which is used as a driver for the sockets, is so designed as to remove all strains, thus insuring the accurate running of sockets, and adding to the life of the chuck.

Once it is set for required size tap, it is absolutely fixed. A clamping nut accomplishes this instantaneously. When the tap strikes the bottom of the hole the friction slips. Owing to the metal to metal friction the action is positive, eliminating the possibility of broken taps.

In order that readers can grasp clearly the uses of the various parts we refer them to Fig. 2, the parts of which are as follows:

ILLUSTRATING THE CONSTRUCTION AND DETAILS OF THE CHUCK.

A. The spindle, made to fit any machise. B. The driving plate; this attachment removes all strain from tang of the spindle. C. The clamping nut. This nut screws into body of chuck and has left hand thread, so that in case it should cut for lack of oil, instead of tightening, it would back off. D. The main body of chuck. The male part of "V" friction is screwed onto end of the spindle and is made of cast iron: This contains two slots in the "V" which insures perfect lubrication. E. Sliding collar. By raising upward it enables operator to remove and replace sockets without stopping the machine. Socket is locked in place by lowering sliding collar. F. The clutch nose piece. The driving is done entirely by this nose piece, which relieves all strain from the recess and guarantees accurate running of sockets at all times. G. The socket for holding taps. H. The socket, for stud setting. I. The bushings for holding taps. J. The bushings for holding stud setters. K. Drill socket.



THE CHUCK COMPLETE, AND OTHER ATTACHMENTS.

These chucks are made for the following size drills and taps:

No. 0 arranged to take from 1-16" to ½"
No. 1 arrangel to take from ⅜" to 1¼"
No. 2 arranged to take from ⅝" to 2"
No. 3 arranged to take from 1½" to 3"

HOIST FOR FURNACE DOORS

Every interesting hydraulic system for raising and lowering heavy doors such as are used on open hearth and heating furnace work has been perfected by the Link-Belt Co. of Chicago, Ill. As this news is of particular interest to those using furnaces with heavy doors, we give, in the following article, a description of the arrangement.

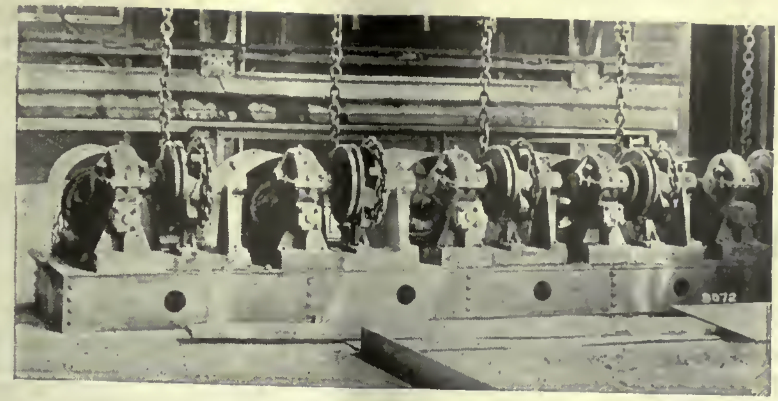
The method has been made foolproof, and, as has been demonstrated, doors thus operated always go up to the proper position and always go down to the proper position, no matter what the weight.

The first installation of this system, made at the plant of the Alan Wood, Iron, and Steel Company, Conshohocken, Pa., has been in continuous operation for fourteen months without repairs, attention, or maintenance expense whatever. Five hoists, with an automatic release, are used in this plant.

On each hoist is mounted a pair of chain sheaves attached to a worm wheel shaft between two flanges which are pinned to the shaft and supplied with fibre friction surfaces on the sides toward the sheaves. The worm wheel is driven by worm mounted on the shaft of a reversible motor, the worm and wheel being inclosed in suitable housing.

To raise the furnace door the motor is started in the direction which will pull down on the left-hand chain. As long as the counterweight continues it pull the sheaves squeeze out against the flanges, and are thereby driven in the direction which will wind up the left-hand chain and thus lift the door.

The right-hand sheave has a fixed stop on its periphery, so located that it will come in contact with a stop on the bottom casting when the furnace door has reached its proper height. With the motion of the right-hand sheave arrested by this stop the shaft cannot rotate the left-hand sheave further gecause the squeeze between the sheaves and friction flanges is relieved. Ther is no opportunity, therefore, for overwinding, and if through carelessness the urrent is not shut off promptly, the shaft with its flanges will simply continue to revolve in sliding frictional contact with the sheaves, but without the power to grip and rotate them further.

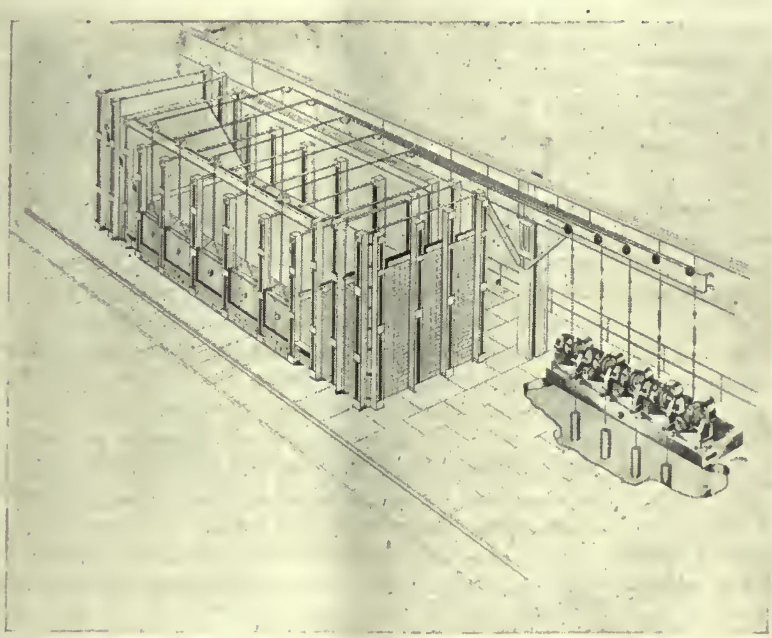


GENERAL VIEW OF CHAIN SLEEVES.

For lowering the doors the direction of the motor is reversed, and practically the same process repeated, except that in this case the power of the motor is used to lift the counterweight, while the pull from the weight of the door serves to keep the sheaves squeezed apart against the friction flanges until a stop on the left-hand sheave engages with a stop in the bottom casting and prevents over-winding of the counterweight chain in the same manner as described for the other sheave.

The stop features do away with the automatic electric switch devices which have proved so troublesome for this type of hoist, and they secure an exact stop for all hoists without involving failure from human carelessness or complicated electrical equipment. The motor is started, stopped or reversed, and the door raised or lowered, by simple push button mechanism.

The photograph and diagram shown with this article will further interest any possible user.



DIAGRAMMATIC VIEW OF THE FURNACE ARRANGEMENT.

NEW THINGS IN MACHINE TOOLS

16 FT. STRAIGHT SIDE PRESS

Williams, White and Company, of Moline, Ill., are now manufacturing a straight side press which has a working length of 16 feet between the housings, and capable of exerting a pressure of 300 tons, distributed load. The width of the ram is 16 inches, and it is provided with a pneumatic counter balance operating at a pressure of from 80 to 100 lbs. per sq. in. A 50 h.p. direct current motor is direct connected to the machine, the initial speed of 775 r.p.m. being reduced to a normal ram speed of 25 strokes per min., the length of the stroke being 5 inches. Friction slip is provided in the fly-wheel to protect the machine against jamming of the dies. The machine is fitted with front and rear adjustable clamping strippers. Side housings are of cast steel and other frame members are made of semi-steel.

ROD POINTING MACHINE

The Kent Machine Company, of Kent, Ohio, has just placed a two-spindle pointing machine on the market that is intended for the pointing of bolt or rods up to ¾ inch in diameter. One operator only is required to run the machine, all he has to do is to insert the work in the gripping chucks, the other operations being performed automatically. Cams actuate the spindles so that one is moved forward while the other is drawn back. Guide bushings are provided for different sizes of work. It is claimed that fifty rods per minute can be pointed by this machine.

NUT FACING MACHINE

A new type of nut facing machine has been developed by the Victor Tool Company, of Waynesboro, Pa., that has many interesting features. The nuts are contained in a magazine and are automatically fed onto a hardened threaded mandrel and against an equalizing collar. When the nut is faced, the backing off of the head operates the friction clutch that reverses the spindle, and fingers on a yoke hold the nut while being unscrewed from the mandrel. The machine has an approximate capacity of twenty ¾-inch nuts per min.

GANG SLITTING AND LEVELLING SHEARS

The Yoder Company, of Cleveland, Ohio, has recently placed on the market a specially designed slitting shear that removes any irregularities in the strip after it has been cut, the long guides and the levelling rolls assuring a perfectly flat piece of metal, free from burrs left by the slitting shear. After being cut the metal strips pass through a set of seven rolls that entirely eliminate any tendency to warp or twist. On metal up to ⅛ inch in thickness, strips as narrow as 2¾ inches may be cut. The machines are made in various sizes to accommodate different widths and thickness of material.

OIL FILTERING CABINET

The Wayne Oil Tank and Pump Company, of Fort Wayne, Ind., has recently placed on the market a new oil filtering cabinet, which is intended to be placed under the machine from which the oil is flowing. The oil, after entering the cabinet, passes through a fine wire screen and is heated to a temperature of about 180 degrees Fahr., and is then delivered to a precipitating chamber where all the grit and sediment is deposited. After passing through cloth filters, the oil is delivered to the storage tanks.

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PRINCIPAL CONTENTS

British Steel Tonnage

THE way in which Great Britain is coming back into the iron and steel markets of the world is a matter of surprise. There have been all sorts of obstacles thrown in the way. There have been strikes of all sorts, lock-outs and transportation troubles, but against all this there has been steady and determined progress, until now her production is greater than the record-breaking months of 1918.

For the first five months of this year the British steel output has been at a greater yearly rate than the total for any calendar year, or at a rate of 9,672,000 tons as against 9,591,000 in 1918 when the pressure of war necessity was driving production figures to new levels.

Before the war Britain's production of iron was greater than that of steel, but now the figures have been reversed.

A fairly large tonnage of British high speed steel is again going into the American market, from which the British makers had to withdraw during the war.

Britain's recovery is well shown in the steel tonnage records she is hanging up through all her troublesome days.

He Urges Use of Caution

CHARLES PIEZ, Presient of the Link-Bedt Co., on behalf of the Illinois Manufacturers' Association, asks the U. S. Railroad Labor Board to go carefully in adjusting new wage awards. He bases his argument on four points:

First: The practice of basing wages on the cost of living, without taking into account the work performed for the wages, is, in our opinion, at the very bottom of the present disturbed and unsatisfactory labor condition. It is usual now in presenting claims for wage advances, to attach an estimated family budget, upon which the percentage of wage increase is predicated. Unfortunately this family budget is presented only to further the claims of a particular body, but we believe it to be the duty of your Board to consider where a universal application of the budget presented in the railroad case would lead.

Second: The divorce of wages from production has been one of the calamities of the war, for it has created in the mind of the wage earner the delusion that irrespective of output, performance, or character of service rendered, he is entitled to live on a certain scale. Statisticians spend their time in developing elaborated lists of family requirements, instead of determining how wage increases based on these requirements can be paid.

Third: The industries have for the past eighteen months been adjusting their wage scales to meet the changed conditions. We think your honorable body should be guided in the final determination of wages to be paid, by the rates obtaining in similar crafts in the industries.

Fourth: The advances in cost of living have affected most adversely the lowest paid wage earners, and the increases in the wages paid unskilled labor have, therefore, been largest.

The Merger Goes On

IT would appear now that the opposition to the formation of the British Empire Steel Merger had been overcome at least for some time. This opposition was being directed chiefly by the late president of the Dominion Steel Corporation, and he was supported by several of the directors of the corporation. The objections held by these gentlemen were not against the merger itself, but against the inclusion of some of the smaller companies which it is proposed to include. At the annual meeting recently these directors all spoke, and demanded more information, claiming they were safeguarding the interests of the shareholders. However, the result of the meeting was the election of a new board of directors, which did not include any of those protesting. It was stated by Col. Grant W. Morden that ample opportunity would be given shareholders to approve or disapprove the amalgamation at a later date.

The formation of this great combination of interests holds such possibilities for our future trade, that given sound financing, its success is assured. Where steelmakers are combined and shipowners have to buy from them, it makes for high prices of steel and ships. If, however, steelmakers and shipbuilders are both actuated by the same interests, it makes for cheaper ships. That is only one aspect of the case. The most promising thing is that with the capital that would be made available the natural resources of the coal and iron districts of Nova Scotia would be developed in a manner that has not yet been approached. We are not among those who see nothing but evil in mergers or trusts, but on the contrary, believe that the solution of the high prices of commodities will be found in the reduction of production costs, made possible by combinations of capital and management. In the engineering field, the most efficient use of the various types of works is made possible by this means, and it is a significant fact that most of the leading engineering firms in Great Britain are now amalgamated, as the result of the conditions prevailing since the armistice.

SEVERAL CHANGES IN THE FAIRBANKS-MORSE CO.

Mr. G. J. Brittain Becomes Vice-President and Sales Manager of The Company—Other Announcements

Mr. G. J. Brittain, formerly managing-director of the Winnipeg, Calgary and Saskatoon Branches of the Canadian Fairbanks-Morse Co., Limited, has been appointed vice-president and general sales manager of that organization, with headquarters in Montreal. Mr. Brittain succeeds Mr. C. Graham Drinkwater, who has been vice-president in charge of sales for many years, and who has resigned to join the banking firm of Aldred & Company, Limited.

G. J. BRITTAIN

Mr. Brittain brings to his new post a wide experience of many years and a splendid record of achievement. He was one of the first salesmen engaged by the Canadian Fairbanks-Morse Co., Limited, in the early days of the Company and he has made good in every position to which he has been appointed. He has the entire confidence and hearty support of all those who know him, both in the organization and as customers.

Mr. Kenneth Forbes, who has been manager of the St. John, N.B., Branch, goes to Winnipeg to assume charge of that Branch, together with that of the Regina Branch, which is under construction at the present.

Mr. Forbes is succeeded at St. John, N.B., by Mr. W. J. Hill. Other changes in the management of the Sales Department—all of which represent well-earned promotion and increased opportunity to assume greater responsibilities—are the appointments of Mr. Malcolm Cordell to be Montreal manager, and Mr. George L. Nies and Mr. Archibald Turnbull, who will become manager of the Calgary and Saskatoon Branches, respectively, taking up a portion of the duties which formerly came under the direction of Mr. Brittain.

A FIRE broke out under the decks of a vessel at New York harbor, and at the time it looked as though a number of men would be roasted like rats in a trap. They were at the front of the vessel in a place where they could not be reached by the firemen.

Fortunately they were engaged with a welding and cutting outfit and of this they made such good use that they were able to cut a hole big enough in the ship plate to allow the imprisoned ones to get out.

Science and industry are constantly adding something worth while to the world's sum total of things that count. Welding and cutting devices have never been recommended or advertised as part and parcel of life saving equipment, but here is a case and here is the evidence.

Artificial Feeding

IT would seem that the new United States merchant marine, having been brought into life very hurriedly, now requires some more than ordinary stimulus to keep it living. The Jones Act, which has recently passed, provides for the abrogation of all treaties which prevent discriminatory duties being imposed on foreign ships, and also prevents United States goods being carried from a U. S. port to another U. S. port via a foreign port in any but a vessel flying the U. S. flag. This would appear to be aimed particularly at the trade which has developed between U. S. ports and Alaska over Canadian railways and by Canadian steamers. The whole measure seems to be a tacit confession that, left to itself, the U. S. merchant marine cannot survive, and that to ensure its prosperity open competition must be eliminated. Whether the course pursued is a wise one is open to doubt. It is not to be supposed that other nations will sit quietly by and see their ships practically barred from United States ports, and still allow vessels of that nation to come and go freely where they list. If a policy of retaliation should be adopted by the maritime nations who are the chief competitors of the United States, it is conceivable that the Jones Act could become a very efficient boomerang. The new merchant marine of our neighbors can become a successful trading fleet only if it can join in world trade, and it would be a comparatively easy matter to effectually bar it from a large portion of the world's ports, to say nothing of coaling and oil fueling stations. It is to be hoped that the formal representations that will doubtless be made by the interested nations to the U. S. Government will result in a modification of the new act, and that a commercial war with all its dangers may be avoided.

A mid-West banker writing to the Financial Post, June 14, says: "Just at the present time agricultural conditions throughout the West are most favorable. We have had some splendid rains, and the weather of late has been such as to bring the grain along at a very fast pace. I think, generally speaking, it is not more than a week behind normal progress, and bids fair to make this up quickly. If this Western country should harvest the present prospective crop there would be plenty of money available this fall to purchase goods made in Eastern Canada."

It might be a good idea at that.

MARKET DEVELOPMENTS

Shipments Still Coming in Very Slowly

Warehouses Handling Premium Shipments Kept Busy Getting From Under Their Obligations—Talk of Another Strike in the Steel Mills of United States, to Start on First of July.

SOME shipments of material have arrived from the steel mills during the past few days, but a good deal of it is coming from the premium operators, and it is taking more money to handle this trade than some of the dealers care to risk. They have to pay a high price in the first place, and so are anxious that the material shall move out quickly when it arrives here. There have been cases where orders at premium prices have been cancelled in transit, the warehouses on this side fearing that the trade would not stay with them in paying prices high enough to let the mout of the obligation they had undertaken. A fair tonnage of black sheets has arrived in Toronto under these conditions, but so far they have been sold out as quickly as the cars are placed. There is the element of risk in the business, but very often premium material is the only kind available.

During the war many makers of tools cut down to two or three much-wanted lines, and by so doing were able to turn out great quantities of these. Now that the demand is more general, there is a tendency on the part of some of them to broaden the field of operation again.

The British steelmakers are coming into the market again. Reports have it that a good tonnage of high speed has been placed in Boston and disposed of. The figures for the first five months of the year show that British mills have turned out more steel than at any previous time, even breaking the records of 1918, when the war was driving production figures to high levels.

Considerable confusion still exists, especially in steel warehouses as to the interpretations of various taxes on imports and sales.

Boiler tubes are much wanted and correspondingly scarce. In some of the large yards it has been two months since a shipment was received, and in ordinary times they would be coming in every week or oftener. Repair work as well as contracts are being held up right in the season when it is usually busiest.

Some material is coming from Canadian bar mills. The trouble is that such a tonnage is booked against the output that it is impossible to satisfy the trade. When flats are being rolled the dealers are busy drawing the attention of the mills to the fact that rounds are urgently needed.

PRODUCTION INCREASES BUT ROADS CAN NOT HANDLE IT QUICKLY YET

Special to CANADIAN MACHINERY.

PITTSBURGH, June 24.—Production of both pig iron and steel has increased a trifle and the rate is now nearly, if not quite up to the rate in March, the best rate attained since October, 1918.

Steel shipments have increased but little, and are still hardly equal to production, though the additions to the large amount of steel accumulated are now small. In occasional instances mills are probably shipping somewhat more steel than they make. Early last week car supplies at some of the plants suddenly dropped off, the explanation offered being that this was due to the establishment of the railroad pools in lake coal and lake ore, under instructions by the Interstate Commerce Commission. A desperate situation had arisen as to lake coal, the Northwest being faced with a fuel famine next winter. The extra car shortage proved to be only temporary. Shipments of tin plate have been excellent, far in excess of the production.

The pig iron and steel markets are very quiet all along the line. There is business being placed, but it is only of routine character, the market being absolutely devoid of snap. Customers of the Steel Corporation are buying freely in so far as the corporation is willing to accept their contracts, and evidently have entire faith in the stability of the Corporation's prices, which are all in accordance with the Industrial Board schedule effective March 21, 1919. The Corporation has given another evidence of its disposition to hold prices down in having allotted some pig iron tonnages to regular customers in the Chicago district at $36 when the independent market is $43, this being in line with its policy on Birmingham iron, which the Corporation has not sold at above $38, the independent market being $42.

Regular customers of independents are limiting their purchases to absolutely known requirements in the case of independents that have particularly high prices, while in the case of independents that are only $10 to $20 above the Corporation prices it is the producer that limits the amount of business placed.

Contracting for Connellsville furnace coke for the second half of the year presents very difficult problems for both producers and consumers. The producers see a present coal market in the Pittsburgh district ranging between $8 and $10 per net ton at mines, and at $9 the market value merely of the ton and a half of coal required to make a ton of coke would be $13.50, while the cost of making coke would be say $1.50, making $15 for coke, to get back the coal value. Coal may be worth much less during the second half of the year, but no one can prove that it will be. To ask $15 for coke would mean that no sales would be precedents the conditions that would be paid might mean a big loss, compared with what might be obtained for the coal.

The furnaceman, on the other hand, does not know whether pig iron is going to advance or decline, but seriously fears that it is going to decline. Some operators have offered "ratio" contracts at 4 to 1 on basic pig iron, which would mean $10.87½ for coke when basic pig iron is $43.50, valley, as at present. If pig iron went to $32 the coke would cost $8 on such a ratio contract, but according to precedents the conditions that would make $32 pig iron would also make coke in the open market worth much less than $8, and thus the furnaceman is puzzled, just as is the case with the coke operator.

Contracts involving about 25,000 tons of coke a month have been closed on the 4 to 1 ratio basis, also contracts for a considerable tonnage at flat prices between $10 and $12. Some operators and furnacemen are indisposed to contract at all, and may get together on the basis of a monthly or weekly adjustment of price during the half year.

PREMIUM LINES TO MOVE OUT QUICKLY

Dealers Prefer to Get High-Priced Materials Off of Their Hands as Soon as Possible

TORONTO.—Warehouses are the busiest places in the steel or machinery market just now. They are busy because they want to keep themselves sold out and they are not finding it very hard yet. Much of the material they are taking in is coming at a pretty fair premium, and in order to keep well inside the safety margin they must hustle and get this stuff out.

In other lines there is an apparent dullness, and this is quite true of the machine tool business for the past week or so. The volume of business is smaller.

During the war there were tendencies developed that have been adhered to so far by machine tool builders, but there is now a willingness on the part of some of them to depart from these ideas. One of the dealers pointed this out to Canadian Machinery to-day. "When the war was on there was a call," he stated, "for certain lines of machinery for the making of shells. This work was taken on by some shops, and they found that by devoting all their time to one or two lines they could get much better production returns, as they were able to work on a quantity basis instead of building each machine or set of machines. They decided that if this were good practice for their shops during the period of the war it was good practice for their shops when the war was over, and they were again operating on peace-time lines. This has been going along very nicely until they find that there is a limit to the market for these special machines. They see other businesses going by now because they are not in shape to go out and take it over. I find there is quite a change coming over some of the firms with whom we do business. A little while ago they would not consider making a proposition on certain lines and sizes, but now there is quite a change in attitude on their part, and I believe that this movement will continue."

Several Canadian dealers have been in Atlantic City during the past few days attending the big railway convention there, where there was a good exhibit of machine tools especially designed for that class of work. As far as can be gathered the feeling seems to be that the railroads of United States are counted upon to do quite a bit of buying in the

POINTS IN WEEK'S MARKETING NOTES

There is talk of another steel strike in the U. S. steel mills starting on July 1.

Britain's output of steel for the first five months of the year shows an increase over any existing record.

Black sheets, 14 and 16 gauge, have been selling as high as 12½ cents per pound.

Boiler tubes are not arriving and they are much needed in many plants.

National Railways are out with a small list of tools—wood and metal working, for the Western shops.

Machine tool trade in this district remains quiet, and large orders are not being placed.

Indications point to a stiffening in the price of Old Country high-speed tools.

Pig iron is being sold in Toronto at $53.80 per ton.

Canadian roads are also out with a small list now, calling for some equipment for the Western shops, including both metal-working and wood-working machinery.

Those Tax Proposals

Many dealers are appealing to customs brokers and to the collectors here for rulings on certain cases as they come up from day to day. Some of the rulings that have been given are not definite enough to enable the collectors to give answers that are definite enough.

One of these sections that affects the sale of machine tools is as follows: 8. (a) "That in addition to the present duty of exercise and customs, a tax of one per cent. shall be imposed, levied and collected on sales and deliveries by manufacturers, wholesalers or jobbers, and on the duty-paid value of importations; than in respect of sales by manufacturers to retailers or consumers, or on importations by retailers or consumers, the tax payable shall be two per cent."

One firm handling among other things small tools, claims that the Government was not intending to protect the jobber, but was simply after the revenue that might go slipping through here by the jobber losing the business that would come to him without the tax being on. The consumer might try and evade the jobbers' tax by buying direct from the maker. The Government, in order to make sure of this, has put on the two per cent. here. There is one point that does not seem certain. Some dealers are charging the buyer with the one per cent. sales tax, while others, especially on small tools, are absorbing it and decreasing their profits to that extent.

Several large shipments of English small tools have arrived during the week and these are being placed on the market. The price seems to be a little lower than that quoted by most of the Canadian firms, but according to some of the Old Country makers they are looking for a stiffening in price of the Old Country high-speed lines. One of the firms representing Old Country lines stated that the British firms were in shape to recover the high-speed steel market in the United States which they lost during the war. As proof of this they called attention to the large order that was placed and shipped to Boston recently of British high-speed steel.

Canadian makers of small tools, it is understood, have notified some of those who have been receiving preferred prices that this practice will be continued. This refers to manufacturers or large buyers who have heretofore been able to buy from the dealer at just as good a figure and under just as good or better chances of quick delivery as from the jobber.

Several of the Canadian makers considered these matters last week, but there was nothing drastic in their programme at Montreal.

Reporting Better Deliveries

Black sheets, especially 14 and 16, have been much wanted and are hard to secure. A good shipment of these came in during the week, and were sold quickly at a price fairly well above what might be considered an ordinary market quotation. The warehouse bringing them in had a top price to take care of.

"This business of handling a fairly large tonnage of premium material when deliveries are slow is not a pleasant task," was the way one warehouseman sized it up. "We know that when we take on the tonnage we are taking with it a risk, but we also know that there are firms all over Canada that will be glad to pay if they can get the material they want. We are always glad when these decidedly peak premiums are cleared out of stock, for we could not be caught with many of such shipments and keep on the right side of the books." There is a tendency on the part of some of the importers to drop premium bookings, and cancellations are more frequent now on short notice than they have been for some months.

Neither have the warehouses become altogether accustomed to the manner of placing and allotting the new taxes. For instance, one firm wanted tubes for a certain boiler, which would come bent. It was not known whether this would be considered a manufactured article and come under a different rating to ordinary boiler tubes. The local collector advised asking Ottawa for a ruling, and Ottawa replied to the wire telling the buyer here to get in touch with the local collector.

Movement of ordinary, standard size boiler tubes is very slow. Some of the dealers state that they have not had a tube in two months, whereas in ordinary times they would be getting in from one to two cars a week.

Bar iron is coming along in fair quantities, one of the Canadian mills at least being able to give fairly good shipment. It seems impossible to please both users of flats and users of rounds. There is, as far as reinforcing rounds are concerned, a definite season when these are in demand and after that has passed they are a dead line.

Pig iron is selling at $53.80 for 2.25 to 2.75 per cent. silicon.

FOUNDRY ACTIVITY IS GIVING SOME RELIEF IN MONTREAL FIELD

Special to CANADIAN MACHINERY.

MONTREAL, June 24.—Definite signs of industrial improvement are slow in coming but indications are beginning to point to a gradual betterment in many directions. The resumption of foundry activities in this district has given relief to many manufacturers, as threatened scarcity was beginning to affect the operations of plants getting outside castings. The modification of the tax budget may have something to do with the optimistic feeling, as manufacturers are better pleased with the changes that have been effected. There appears to be a slight break in railroad congestion, and this is more favorable to the consuming trade, and this condition will do much to infuse confidence into general industrial enterprise. The steel situation is still suffering from unbalanced supply and demand, but even here the outlook is encouraging. Old material movement is comparatively quiet, being a reflection of industrial curtailment, resulting from irregular producing supplies.

Hopeful of Early Improvement

Apart from the encouraging reports of increased steel output from the producing mills, the general situation remains unchanged. Deliveries are still irregular, as transportation facilities are inadequate to meet the requirements of the trade. Present conditions will prevail until railroad congestion is relieved and the freight now in transit has reached its destination, thus releasing many cars that are now tied up. The disorganization of railroad operation, during the strike and since, has meant the employment of many new men and reasonable time must elapse before normal operations can be resumed. Despite the rumors that have been heard of, large quantities of steel being held in reserve at some of the mills, visits by Canadian dealers fail to disclose any stocks of abnormal magnitude. It is true that some yards in the States have large supplies in the yards, but the bulk of this is awaiting shipment to previous purchasers, whose orders have been on the books for months. Existing conditions cannot prevent the accumulation of material at producing points and is not improbable that freer shipments will result in an easier market. Such a change would not only aid in the removal of finished product but would allow much needed raw materials to pass to the mills, and, in consequence, permit increased activity in the way of production. Some dealers here have been able to satisfy customers in the way of sheets and tubes, as incoming supply has been slightly improved, but the demand is still such as to prevent other than temporary warehouse stocks.

Uncertain Delivery Affects Trade

Machine tool activity is still gauged by the period of time that must elapse between the placing of the order and the receipt of the equipment. This factor of shipping is still so very uncertain that buying of tools is still deferred awaiting more definite assurance of delivery. In some cases dealers state that surprises have been given to customers in the way of prompt shipment, but when asked for an explanation the dealer himself is unable to give one, and could give no further reason than that it was due to the prevailing uncertainty. Dealers have reports of shipments that have been on the way for from six to eight weeks, and others where equipment has come through in a few days, even before the invoice. English goods are coming in regularly, and while delivery dates are never definite, the receipt of material from this source is invariably more certain than from the States. Large machine tool orders are seldom placed now, but small lots, widely distributed, retain the interest of the trade. Used equipment is still in demand but the week's sales have been lighter. Supplies are in good demand but affected by uncertain shipments.

Quiet Week in Scrap

Improvement in scrap activity is almost entirely confined to the slightly better demand for foundry scrap. This is probably due to the resumption of work in local shops following a brief period of idleness. The restricted activity in many lines, as a result of indefeinite and delayed deliveries of madefinite and delayed deliveries of materials and dealers report a quiet week with little prospect of early betterment. A slightly increased demand has been noted on scrap zinc and brass, but only of a temporary character. While dealers are not forcing a decline it is believed that the market is generally weaker. The needs of the trade, apparently, are as insistent as ever, but owing to the prevailing uncertainty regarding deliveries many plants are forced to curtail production. Dealers state that normal conditions will probably be revived when the railroad situation becomes stabilized. Price quotations are unchanged but with a weak undertone.

MONTREAL NOTES

McLean Kennedy, Ltd., as agents for the Houston Line, announce the inauguration of a new steamship service between Montreal and the Far East. This service will commence with the sailing of the Clan Campbell about the middle of July.

The McClary Manufacturing Company have just about completd the four-storey addition to their Montreal factory. This section has been built on the south-east corner of the old building and will provide an additional 20,000 square feet of floor space.

The fortieth annual convention of the American Water Works Association is being held in Montreal this week. Over 800 delegates from all over Canada and the United States are in attendance at the Windsor Hotel, where the business meetings will be held.

An interesting exhibition is being held at the present time at McGill University. This display will represent the treasures of the Redpath Library, which contains many valuable documents and original editions of books and papers dealing with America in its infancy.

J. T. McCall, of Drummond and McCall, has just presented a scholarship to McGill University in honor of his son, James D. McCall, who was drowned in Lake Wayagamack last year. Young Mr. McCall entered McGill in 1911 and graduated in 1915, leaving shortly afterwards for France, where he served with distinction in the Royal Air Force.

The launch of the "Canadian Victor" from the yard of the Canadian Vickers, Ltd., on June 22, is the third that this company has placed in the water this spring. The first two were for Norwegian interests. Five other steel vessels are under construction at the present time, and it is expected that these will all be launched before the fall. Two of these are for Norwegian shipping companies and the remaining three are for the Canadian Government. The total tonnage that this company will construct this year will approximate 70,000 tons.

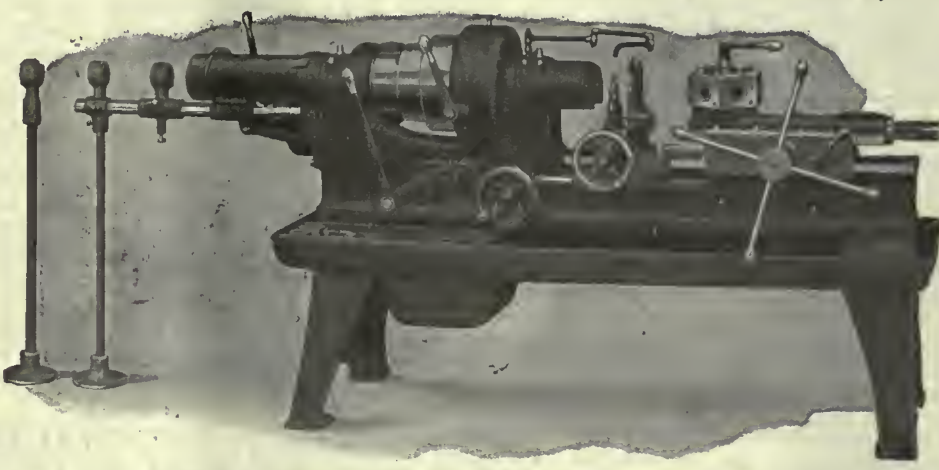
Several new coal discoveries have been made in southern Chile, says "Engineering." One of these, near La Union, is estimated to contain 40,000,000 tons, and a special railway is being built to the Rapalla Station. Another coal deposit has been found in the Department of Castro. The greater part of the coal field is on the beach in the northern part of Castro Bay. The coal from this region is different from that in other parts of Chile, and is not unlike cannel.

The burial took place at St. Catharines, Ont., of Captain John Dewey, a lifelong resident of St. Catharines, and a noted Canadian marine engineer. He died at the home of his daughter, Mrs. Thomas Welch, at Buffalo.

Warner & Swansey Screw Machines

For large output and close limits—If you are figuring on screw machine work you can depend on W. & S. machines being right for the job.

We can supply you from stock immediately.



The A. R. Williams Machinery Company, Limited

ST. JOHN, N.B.
WINNIPEG, VANCOUVER

If It's Machinery—"Write Williams"

64 Front Street West
TORONTO

Gray Iron and Semi Steel Castings of all Descriptions

From 5 lbs. up to 4 tons

Foundry capacity, 15 tons per day.

Difficult castings our specialty.

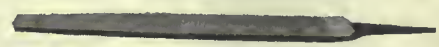
Mixtures regulated by chemical analysis and all castings sandblasted.

Estimates from blue prints submitted promptly.

If desired, we can make patterns to your drawings.

G. W. MacFarlane Engineering, Limited

Paris, Ontario



TO-DAY

is not too early,
or too late,
to start
the use
of

P⨉H **P.H. or Imperial Files** IMPERIAL

"They cut faster and wear longer."

Be File-Wise

Ingersoll File Company, Limited

John Morrow Screw and Nut Co., Ltd.
Sole Distributors,
Ingersoll, Ontario

INGERSOLL

Another Steel Strike to Start on July 1 ?

Pittsburgh Thinks Both Labor Unions Are Striving to Lead Race in Calling Men Out of the Mills—Some Interesting Sidelights on What is Going on in the Pittsburgh District

Special to CANADIAN MACHINERY.

PITTSBURGH, June 24.—At this whiting the extent of the steel strike, July 1, cannot be forecast. The strike may not even include all of the sheet and tin plate mills that have hitherto been union, or it may be considerably more extensive. On account of the break, or partial break, between the Amalgamated Association and the Federation of Labor, with which it has been affiliated, both organizations may attempt a strike July 1. Before the Amalgamated Association broke with the sheet and tin mills at Atlantic City, June 14, the report was that the American Federation of Labor intended to call a steel strike for July 1, and then prosecute the work of organization, which has not gotten far since the last strike played out. The Amalgamated Association does not want the Federation to have anything to do with the iron and steel industry, claiming that by reason of its several decades of existence the Amalgamated Association has a prior right to attempt to control the industry.

How little understanding there is of present circumstances is illustrated by an editorial in the leading iron and steel trade paper of the United States, commending the Amalgamated Association for its wisdom and conservatism in breaking with the American Federation of Labor, interpreting this action as being due to the Amalgamated Association's principles being too lofty to countenance the Federation's desire in the recent iron and steel trade crisis that the Amalgamated Association break its scale agreements and go on strike. The real animus of the Amalgamated Association is to beat the Federation to an iron and steel strike.

The conference on the sheet and tin plate wage scales at Atlantic City was confined almost entirely to discussion of the amendment the Amalgamated Association proposed to the preamble. The association has controlled only the hot mill or tonnage labor, together with the tin house workers, if the sheet and tin plate plants it controlled at all. The preamble has always provided that should the association organize other departments during the scale year, which runs from July 1, scales could be presented, but in event of disagreement the matter should rest until the expiration of the scale year, the men for whom the scale was signed remaining at work meanwhile. The amendment proposed was that work should terminate upon disagreement in such a case at any time after July 31.

This meant, in substance, that the Amalgamated Association could at any time organize the picklers, or the open-hearth steel workers, or any others, and if the demands were not granted they could close the hot mills. With such power the Amalgamated Association up to the limit of its own strength. The plan evidently was to force by steps the could organize any departments it chose, organization of the entire iron and steel industry. Two of the union sheet mills, for instance, have blast furnaces, and thus there would be opportunity to organize the workers at those blast furnaces, the organization of other blast furnaces then being attempted.

Roughly speaking, the Amalgamated Association controls about 40 per cent. of the sheet and tin mills, the 60 per cent. non-union including all the Steel Corporation plants. Whether all the union sheet and tin mills will close July 1, is to be ascertained by waiting to see. According to the present outlook several of the manufacturers intend to make the effort to run. On the other hand, the Amalgamated Association will doubtless try to organize the non-union mills, and it is possible the American Federation of Labor will call a strike for July 1, and also attempt to organize the mills.

Impending labor troubles may help to explain the eagerness of the steel mills at this time to operate as fully as possible, despite the fact that they cannot ship all their current output, and at the same time have large stocks, while the consuming demand can hardly be as large as it was two or three months ago.

WHAT THE FOUNDRY AND MACHINE SHOP BUSINESS AMOUNTED TO IN 1918

The Dominion Bureau of Statistics has recently compiled a review indicating the status in 1918 of foundry and machine shops in Canada. The report covers the operations of 687 individual plants distributed by location in the following order: Ontario, 369; Quebec, 126; Nova Scotia, 23; New Brunswick, 13; Prince Edward Island, 4; Manitoba, 23; Saskatchewan, 25; Alberta, 15; British Columbia, 69.

This is an industry that is not peculiarly adapted to any one locality, but it rather tends to follow the growth of population and as each community develops it provides the opportunity for the enterprising machinist to step in and take care of local needs.

The capital invested in this industry in 1918 was $84,122,446, divided among the provinces as follows: Ontario, $56,-880,631: Quebec, $14,276,674; British Columbia, $3,635,563; Manitoba, $2,781,-536; New Brunswick, $2,623,056; Nova Scotia, $2,007,191; Alberta, $1,176,932; Saskatchewan, $508,423; Prince Edward Island, $232,440.

These industries distribute in salaries and wages, $28,986,306. They consume fuel to the value of $2,654,145, consisting of coal, coke, gasoline, fuel, oils, gas, natural and artificial.

Miscellaneous expenses, including rent of office, rent of power, insurance, taxes, advertising and travelling expenses, repairs to buildings and machinery amount to $8,553,509. Materials used cost $27,-788,059, consisting principally of pig and scrap iron, bar and sheet iron, black and galvanized iron, malleable and wrought iron, castings, sheet plate and tool steels, steel bars, billets and other shapes, brass and bronze castings, tin sheet and pig copner.

The products of these industries reach in value $82,493,897, and take the form of iron, brass and copper castings, stoves of all kinds, furnaces, radiators, machinery, tools, tinware, car wheels, foundry supplies.

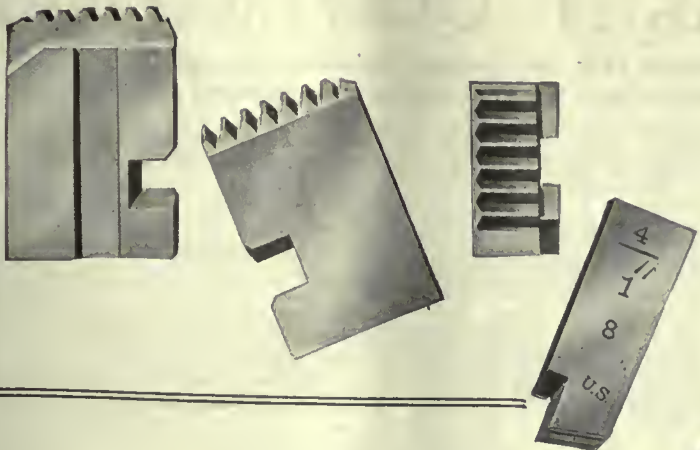
SEES BIG FUTURE FOR THE YARDS HERE

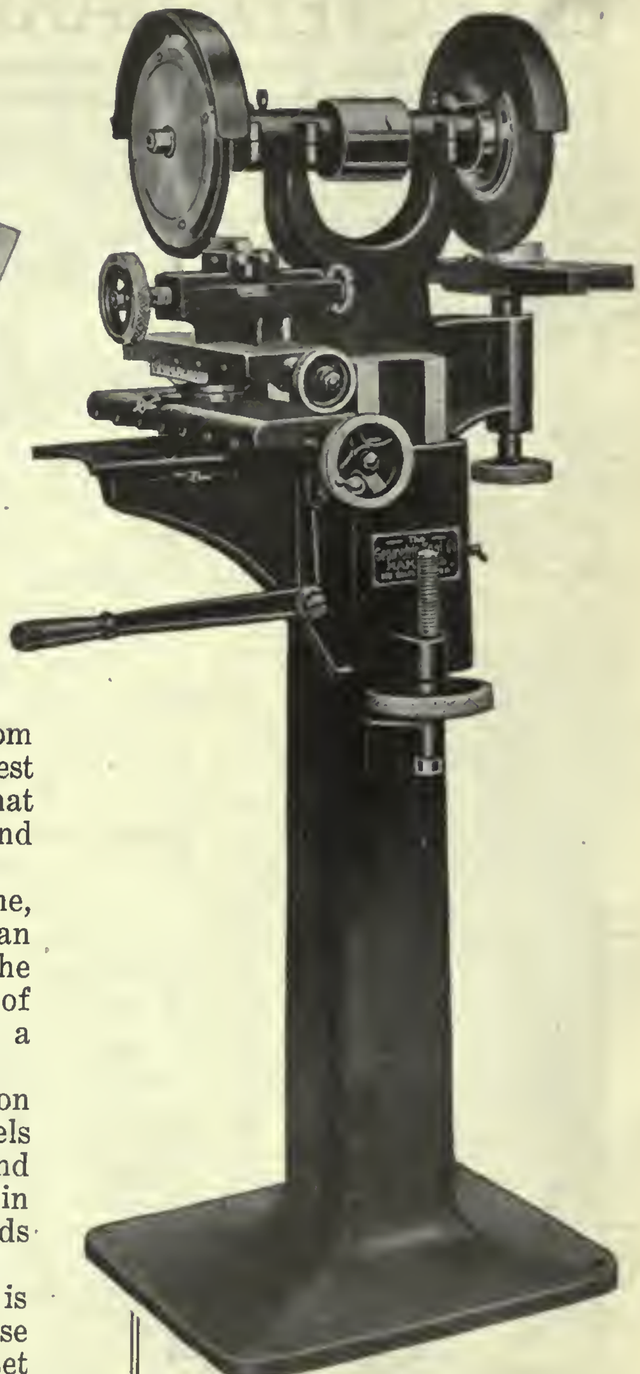
Sir James McKechnie Optimistic on Chances of Shipbuilding in Canada

In the group of gentlemen interested in the proposed merger who were to be seen at the Ritz-Carlton, Montreal, a prominent figure was Sir James McKechnie, K.B.E. Sir James is managing director of Vickers, Limited, at Barrow-in-Furness, England, and is considered one of the foremost engineers and marine architects in the world. To the Gazette representative, he stated:

"I have just returned from an inspection trip of the shipbuilding plants proposed to be absorbed in the British Empire Steel Corporation. I am surprised at their magnitude, and also at the economical layout of the plants, and I have seen the most modern machinery in these plants that exists anywhere today, and for the first time in my life I am ready to admit that there is a great future for the shipbuilding industry in Canada.

"I have no hesitation in saying that the acquisition of the companies owning these plants is absolutely essential, in my opinion, to the existence of the British Empire Steel Corporation. It will only be following out the same lines as have been adopted by the United tSates Stetel Corporation and our big steel interests in England, where they have control of their shipping and shipbuilding plants."





Sharp Chasers Cut Clean Threads

Accurate, uniform threads result only from dies which are maintained in the highest state of cutting efficiency. This means that chasers must be kept sharp, and ground uniformly.

Even if just touched up from time to time, the chasers respond splendidly, with clean threads. And with this machine — the Geometric Chaser Grinder—the matter of keeping threading tools up to scratch is a comparatively simple matter.

Various makes of chasers can be ground on this adaptable machine. The two wheels permit the easy grinding of both milled and tapped chasers. In addition, the plain wheel lends itself readily to various kinds of tool grinding.

Uniform grinding of a set of chasers is purely a mechanical matter through the use of adjustments which can be accurately set to govern the grinding of an entire set of chasers.

The Catalogue describing this machine is a mine of information on chaser grinding. Write for it.

THE GEOMETRIC TOOL COMPANY

NEW HAVEN CONNECTICUT

Canadian Agents: Williams & Wilson, Ltd., Montreal; The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg, and St. John, N.B.; The Canadian Fairbanks-Morse Co., Ltd., Manitoba, Saskatchewan, Alberta.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$42 40
Lake Superior, charcoal, Chicago	57 00
Standard low phos., Philadelphia	50 00
Bessemer, Pittsburgh	43 00
Basic, Valley furnace	42 90
Toronto price:—	
Silicon, 2.25% to 2.75%	52 00
No. 2 Foundry, 1.75 to 2.25%	50 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 50
Steel bars, base, Toronto	5 50
Iron bars, base, Montreal	5 50
Steel bars, base, Montreal	5 50
Reinforcing bars, base	5 00
Steel hoops	7 00
Norway iron	11 00
Tire steel	5 75
Spring steel	10 00
Band steel, No. 10 gauge and 3-16 in. base	6 00
Chequered floor plate, 3-16 in.	8 40
Chequered floor plate, ¼ in.	8 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	4 00
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75

F.O.B., Toronto Warehouse

Small shapes	4 25

F.O.B. Chicago Warehouse

Steel bars	3 62
Structural shapes	3 72
Plates	3 67 to 5 50
Small shapes under 3"	3 62

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

Gross.

	Montreal	Toronto
Lake copper	$25 00	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	66 00	65 00
Spelter	12 00	12 00
Lead	11 50	11 00
Antimony	14 50	14 00
Aluminum	34 00	36 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 7 25	$ 7 25
Plates, ¼ up	6 50	6 50

PIPE—WROUGHT

Price List No. 44—April, 1920.

STANDARD BUTTWELD S/C

	Steel Black	Steel Galv.	Gen. Wrot. Iron Black	Gen. Wrot. Iron Galv.
⅛ in.	$6 60	$ 8 50	....	....
¼ in.	5 18	7 26	$ 6 43	$ 7 56
⅜ in.	5 13	7 25	5 43	7 56
½ in.	6 84	8 42	7 27	8 84
¾ in.	8 45	10 58	9 03	11 16
1 in.	12 50	15 64	13 35	16 49
1¼ in.	16 91	21 16	18 06	22 31
1½ in.	20 21	25 30	21 59	26 68
2 in.	27 20	34 04	29 05	35 89
2½ in.	43 00	53 82	....	....
8 in.	56 23	70 38	....	....
3½ in.	71 30	88 32	....	....
4 in.	84 48	104 64	....	....

STANDARD LAPWELD S/C

	Steel Black	Steel Galv.	Gen. Wrot. Iron Black	Gen. Wrot. Iron Galv.
2 in.	$30 90	$37 74	$34 60	$41 44
2½ in.	45 34	56 16	51 19	62 01
3 in.	59 29	73 44	66 94	81 09
8½ in.	73 14	90 16	82 34	99 36
4 in.	86 66	106 82	97 56	117 72
4½ in.	0 98	1 23	1 24	1 49
5 in.	1 15	1 44	1 44	1 73
6½ in.	1 49	1 86	1 87	2 25
7 in.	1 94	2 43	2 42	2 90
8-L in.	2 04	2 55	2 54	3 05
8 in.	2 35	2 94	2 92	3 61
9 in.	2 81	3 52	3 50	4 21
10-L in.	2 61	3 26	3 25	8 90
10 in.	3 36	4 20	4 18	6 03

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.

4½" and larger, 50%.

4" and under, running thread, 30%.

Standard couplings, 4-in. and under, 30%.

Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices.

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$15 00	$14 00
Copper, crucible	18 00	18 00
Copper, heavy	18 00	18 00
Copper wire	18 00	18 00
No. 1 machine composition	16 00	17 00
New brass cuttings	11 00	11 75
Red brass cuttings	14 00	15 75
Yellow brass turnings	8 50	9 50
Light brass	7 00	7 00
Medium brass	8 00	7 75
Scrap zinc	6 50	6 00
Heavy lead	7 50	7 75
Tea lead	4 50	5 00
Aluminum	19 00	20 00

	Per Ton	Gross
Heavy melting steel	18 00	18 00
Boiler plate	15 50	15 00
Axles (wrought iron)	22 00	20 00
Rails (scrap)	18 00	18 00
Malleable scrap	25 00	25 00
No. 1 machine east iron	32 00	33 00
Pipe, wrought	12 00	12 00
Car wheel	26 00	26 00
Steel axles	22 00	20 00
Mach. shop turnings	11 00	11 00
Stove plate	26 50	25 00
Cast boring	12 00	12 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜-in. and less	10
Carriage bolts, 7-16 and up	Net
Coach and lag screws	25
Stove bolts	55
Wrought washers	45
Elevator bolts	Net
Machine bolts, 7/16 and over	Net
Machine bolts, ⅜-in. and less	15
Blank bolts	Net
Bolt ends	Net
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square, blank	add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 50
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	25 and 5
Sq. and hex. hd. cap screws	22½
Rd. and fil. hd. cap screws... plus	17½
Flat but. hd. cap screws .. plus	30
Fin. and semi-fin. nuts up to 1-in.	20
Fin. and Semi-fin. nuts, over 1 in., up to 1½-in.	10
Fin. and Semi-fin. nuts over 1½ in., up to 2-in.	Net
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws ......list plus 20,	30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$60 00
Open-hearth billets	60 00
O.H. sheet bars	76 00
Forging billets	56 00-75 00
Wire rods	52 00-70 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 70
Cut nails	5 85
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 35½
British Manila rope	0 28
New Zealand hemp	0 28
Transmission rope, Manila	0 47
Cotton rope, ¼-in. and up	0 88

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net

MISCELLANEOUS

Solder, strictly	$ 0 40
Solder, guaranteed	0 43
Babbitt metals	.18 to 70
Soldering coppers, lb.	0 62
Lead wool, per lb.	0 16
Putty, 100-lb. drums	8 30
White lead, pure, cwt.	20 00
Red dry lead, 100-lb. kegs, per cwt.	16 50
Glue, English	0 40
Tarred slater's paper, roll	1 30
Gasoline, per gal., bulk	0 35
Benzine, per gal., bulk	0 35
Pure turp., single bbls., gal.	3 60
Linseed oil, raw, single bbls.	3 00
Linseed oil, boiled, single bbls.	3 03
Sandpaper, B. & A.	List plus 43
Emery cloth	List plus 37½
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin, "D," per lb.	0 14
Borax crystal and granular	0 14
Wood alcohol, per gal.	2 70
Whiting, plain, per 100 lbs.	2 75

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes	32½
Can. carbon cutters, plus	20
Standard drills, all sizes	32½
3-fluted drills, plus	10
Jobbers' and letter sizes	32½
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	net.
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus 20 to	40
Can. high speed cutters, net to plus	10
American plus	40

COLD ROLLED STEEL

[At warehouse]

Rounds and squares	$7 base
Hexagons and flats	$7.75 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	60	75
Class B	27	37
Class C	18	27

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 8 50	$ 9 50
Sheets, Blue ann., No. 10	8 50	9 00
Canada plates, dull, 52 sheets	8 50	10 00
Can. plates, all bright	8 60	9 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	11 00	....
Fleur-de-Lis, 28 B.W.G.	10 50	....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28, U.S.	11 50	10 50
Premier, 10¾-oz.	11 50	10 90
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅝ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	29 50
1¾ in.	31 50	30 00
2 in.	35 00	30 00
2¼ in.	35 00	29 00
2½ in.	42 00	37 00
3 in.	50 00	48 00
3¼ in.	.. ..	48 50
3½ in.	63 00	51 50
4 in.	85 00	65 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	.....
Royalite, per gal., bulk	24½
Palacine	27½
Machine oil, per gal.	43½
Black oil, per gal.	18½
Cylinder oil, Capital	82
Cylinder oil, Acme	70
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	$2 60
Union thread cutting oil, antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil, bbls., net	13½

BELTING—No 1 OAK TANNED

Extra heavy, single and double	10%
Standard	10%
Cut leather lacing, No. 1	2 75
Leather in side	2 40

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 60
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	09
Pumice, ground	06
Emery glue	30
Tripoli composition	09
Crocus composition	12
Emery composition	10
Rouge, silver	60
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08¼
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE

XXX Extra	.24	Atlas	.20
Peerless	.22½	X Empire	.19½
Grand	.22½	Ideal	.19
Superior	.22½	X Press	.17½
X L C R	.21		

Colored

Lion	.17	Popular	.13
Standard	.15	Keen	.11
No. 1	.15		

Wool Packing

Arrow	.35	Anvil	.22
Axle	.28	Anchor	.17

Washed Wipers

Select White	.20	Dark colored	.09
Mixed colored	.10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades... 15%

ANODES

Nickel	.58 to .65
Copper	.38 to .45
Tin	.70 to .70
Zinc	.18 to .18

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10..		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6 x 4 base	45 00	44 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 75	$14 50
Sheets, 3½ lbs. sq. ft.	10 50	14 00
Sheets, 4 to 6 lbs. sq. ft.	10 25	13 50

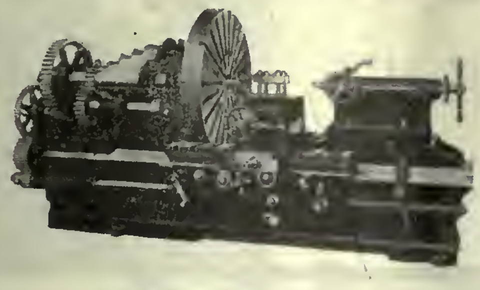
Cut sheets, ½c per lb. extra.

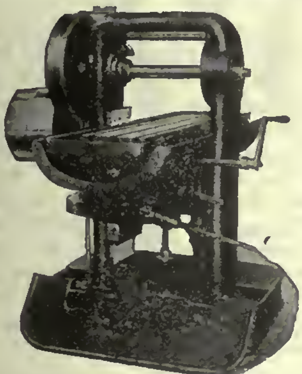
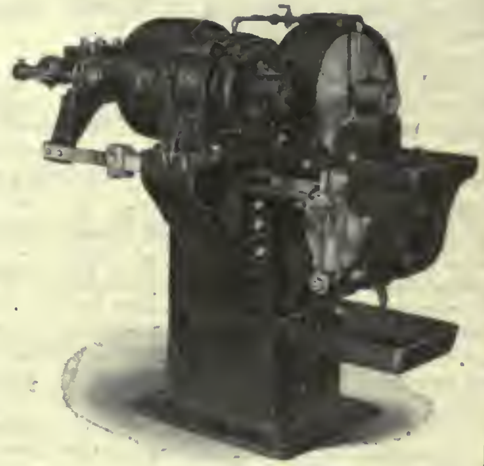
Cut sheets to size, 1c per lb. extra.

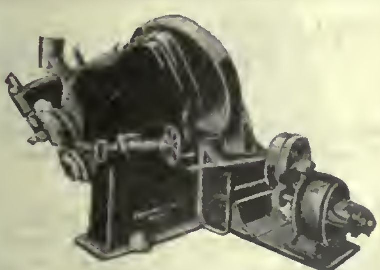
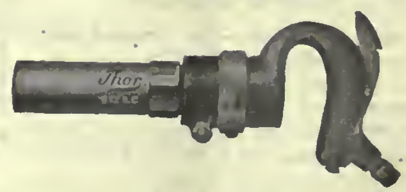
PLATING CHEMICALS

Acid, boracic	$ .23
Acid, hydrochloric	.03¼
Acid, nitric	.10
Acid, sulphuric	.03¼
Ammonia, aqua	.15
Ammonium, carbonate	.20
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, annhy	.41
Copper, sulphate	.16
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.08
Nickel carbonate	.32
Nickel sulphate	.19
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.25
Silver nitrate (per oz.)	1.20
Sodium bisulphate	.11
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.18
Tin chloride	1.00
Zinc chloride, C.P.	.30
Xinc sulphate	.08

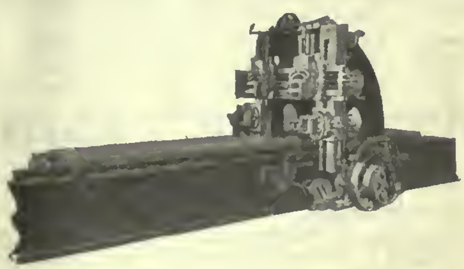
Prices per lb. unless otherwise stated







INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES

TRADE GOSSIP

Meeting in Woodstock.—The stationary engineers of the province are holding their annual convention in Woodstock. Upwards of 500 delegates from all parts of Ontario and outside points attended. The big exhibit of power machinery and accessories opened in the market building on Wednesday. The delegates are to be the guests of the local motor club.

Strikers Return.—The machinists of the steel plant of the Dominion Steel Corporation, after a strike of two months' duration, have returned to work. The men are to get 68 cents an hour for a 10-hour day, time and a half for Saturday work, and double time for Sundays and overtime. They will only work 5 12-hour night shifts each week instead of 7 12-hour night shifts as at present. The settlement of the strike is a matter of relief to the entire community.

Gonzaba Launched.—An ocean-going steel cargo freighter, SS. Gonzaba, designed to carry 2,550 tons deadweight, was launched on Saturday at the Bathurst Street wharf by the Dominion Shipbuilding & Repair Co. The ship's principal dimensions are: Length over all, 261 feet; molded breadth, 39 ft. 6 in.; depth molded, 19 ft. 4 in. It is classed at Lloyd's 100 A1, and is equipped with triple expansion reciprocating engines, 950 horsepower, two Scotch marine boilers of 180 lbs. pressure.

HAMILTON MEN ARE PLANNING A TRIP

Manufacturers Will Go West With a Special "Made-in-Hamilton" Train Exhibit

At a meeting of the board of directors of the Hamilton Chamber of Commerce, C. W. Kirkpatrick, industrial commissioner, explained to the board a plan for a tour through the Western Provinces for a number of Hamilton manufacturers by special train which would carry with it an exhibit of Made-in-Hamilton goods. It was considered that a trip of this kind would be an excellent advertisement for Hamilton and would do a great deal to promote harmonious relations between the manufacturers and business men of the East and West. The board of directors heartily endorsed this plan, and will appoint a committee to take the matter up.

WHAT CANADA GETS FROM THE STATES

Figures Show What This Market is Worth For Machinery, Iron and Tin

Washington.—England is still the chief purchaser of American metal working machinery. Out of a total exportation of these machines of $3,613,721, in April, 1920, $1,027,559 went to England. France was second with $780,136; Canada third with $473,504, and Japan fourth with $358,241.

In our exportation of tin plate, terne plate and taggers' tin, Japan led all of our customers. Her receipts during April, 1920, were 18,635,111 lb., valued at $1,453,943, out of a total export of these commodities of 51,650,920 lb., worth $3,892,017. Canada was next with 9,113,504 lb., worth $653,789, and Brazil third, with 5,736,566 lb., worth $424,551. Then came China with 2,807,419 lb. at $218,938, and England fifth, with 2,085,994 lb., at $184,545.

Belleville's Growth.—C. I. White, in his report to the Belleville City Council on the first year's work of the Industrial Commission, points out that seven industries have been secured for Belleville in that period: The Elliott Machinery Co., the Judge Jones Milling Co., the H. A. Wood Manufacturing Co., the Natural Tread Shoe Co., the Toronto Hat Manufacturing Co., the A. S. Richardson Co., and the Wood Harvesting Machine Co.

To Build Plant.—Plans for a $75,000 plant which the Dominion Oxygen Company, Ltd., proposes to erect on Erin Street, Winnipeg, were approved by the civic works committee. The company proposes to manufacture oxygen for welding purposes by taking it from the air. The gas container will be of about 50,000 cubic feet capacity, and the plant will be equipped with all safety appliances, it was stated. S. J. Rothwell and G. L. Lennox, solicitors for the company, appeared in support of the application for a permit to go ahead with construction.

To Aid Shipbuilders.—A resolution designed to assist shipbuilding yards in carrying out their contracts for vessels over 3,000 tons, has been placed on the order paper of the Commons in the name of Sir Henry Drayton, Minister of Finance. The resolution provides that the Minister of Finance may be authorized by the Governor-in-Council to endorse promissory notes drawn by the purchaser in favor of the shipbuilder for fifty per cent. of the purchase price where the remaining half of the cost has been provided for. The vessels will be mortgaged to His Majesty for the full amounts of the notes so endorsed and fully insured, and the vessels shall be registered in Canada and the register shall not be transferred until the mortgage has been cleared off.

DEVELOP THE STEEL INDUSTRY

Death of K. W. Blackwell at Montreal—Vice-President of Canadian Steel Foundries

The death occurred at his residence, 103 Crescent Street, Montreal, after a brief illness, of Mr. Kenneth William Blackwell, vice-president of the Canadian Steel Foundries, Limited.

Mr. Blackwell, son of the late Thomas E. Blackwell, was born in Devizes, Wiltshire, England, nearly seventy years ago, and came to Canada when a youth with his father, who was the first general manager of the Grand Trunk Railway. He was educated at Bishop's College School, Lennoxville, and was apprenticed as a mechanical engineer in the G. T. R. shops, Point St. Charles. He was later appointed mechanical superintendent of the G. T. R. for the division between Montreal and Toronto, with headquarters at Belleville. Subsequently he became mechanical superintendent of the Chicago and Grand Trunk Railway, and later joined the C. P. R. as mechanical superintendent.

In 1882 he went into the manufacturing business under the name of K. W. Blackwell, manufacturing railway car springs, etc. This business later became a joint stock company of which Mr. Blackwell was president, the firm subsequently becoming Montreal Steel Works, Limited, of which Mr. Blackwell was president and managing director. The company was absorbed by the Canadian Car and Foundry Company under the name of Canadian Steel Foundries, Limited, Mr. Blackwell being vice-president up till the time of his death.

When we work hard with our body all day our backs ache and our muscles ache. This is all right, for nature has given us sweet refreshing slumber to drive away the aches and pains so that on the morrow we are ready for the fray.

It's better to wear out than to rust out.

MORROW

Order from Your Jobber

No Reliable Jobber will Substitute

FORGED drills are built on scientific principles with a view to MAXIMUM PRODUCTION. They are made from hammered bars of high speed steel (not less than 18% tungsten content).

The drills are forged at plant No. 3 and are hot TWISTED (the grain of the steel runs with the twist). They withstand the torsional strain under most exacting duty and give more holes with less re-grinding.

YOU SEND AN ORDER NOW. ORDER BY THE NAME "MORROW".

The John Morrow Screw & Nut Co., Limited

INGERSOLL, CANADA

7 Hop Exchange, Southwark St., London, England.

Montreal 131 St. Paul St.	Winnipeg Confederation Life Building	Vancouver 1290 Homer St.

Set and Cap Screws Engine Studs, Nuts, Files and Rasps.

CARBON IN STEELS

Continued from page 593

edges are cold. The edges are then quickly rubbed with an old file or a piece of firebrick or emery cloth tacked upon a block of wood. This is done so that the color can be easily seen—the color travelling down toward the shank or point. When the desired color reaches the cutting edge, the tool is plunged into cold water and the job is done. Appended is a list of tempering colors, each one representing a lower degree of hardness than the one preceding it.

List of Tempering Colors Used by Blacksmith

Straw color is the hardest. Brown the next. Now comes light purple, dark purple, deep blue and pale blue.

Straw color is suitable for cold chisels where light blows are struck, or for other work where great hardness is required. Where heavy blows are delivered, it is best to temper the chisel to a brown color. Screwdrivers should be colored a light purple and springs or other articles that require to have great toughness with a reasonable amount of hardness should be tempered to a deep blue color.

There is another kind of steel on the market called "high-speed" steel. This is a most remarkable metal and is the best tool steel for roughing down work that the writer has ever used, it being of such toughness and hardness that very heavy cuts can be taken; so heavy, in fact, that the cutting edge gets red-hot and it operates for a long time in that condition before requiring regrinding. The writer has also tried this class of steel for turning rolls. With the exception of chilled rolls, which the steel would not cut at all, it proved to be very fine on all other classes of rolls, enabling the work to be completed in far quicker time than the best crucible tool steel would allow. The crucible steel tools seemed to be better suited for turning chilled rolls, and also the ones containing manganese, the carbon element being the ingredient required for turning chilled work. Singularly enough, the high-speed variety of steel contains very little carbon in comparison with the crucible or open-hearth metal; it depending for its hardness and toughness upon the addition of chromium, cobalt, molybdenum, tungsten, nickel, vanadium and other rare metals which impart to it the extraordinary characteristics of cutting metal when the point of the tool is red hot, the chip in this case coming off with a deep blue color. Each manufacturer has his pet formula for manufacturing this kind of tool steel, they using some or all of the above ingredients. High-speed steel is very expensive and on account of this fact, all shops do not use it, but the demand is increasing every year, the late war making very heavy demands on it. High-speed steel cuts the overhead cost of manufacturing down to a minimum by allowing a far greater output to be secured from machines in a day's work.

This class of steel requires different treatment in hardening, it being necessary to heat it to a "white heat," which latter would positively ruin the best crucible or any of the usual kinds of tool-cutting steels. The best plan for cooling high-speed is to do the work in an air-blast, although oil can be used. I find it will not hold its cutting edge for as long a time as when the air-blast is used as a cooling medium. This steel, unlike crucible steel, does not need tempering after hardening, as it gives the best service when left hard.

TRADE GOSSIP

Incorporation has been granted to Copper Products, Limited. The capital is limited to $3,000,000, and the head office is located at Montreal.

Dominion Novelty Co. has been given incorporation at Ottawa, to manufacture, buy, sell, etc., automatic weighing machines, etc. The head office of the company is at Hampton, N.B., and the capital $50,000.

Incorporation has been granted to the Hutchins Car Roofing Co., Ltd., with head office in Montreal, to carry on business as iron and steel founders, etc., and handle all materials that enter into the construction of car roofs, etc. Capital is placed at $500,000.

Incorporation has been granted at Ottawa to the Corundo Steel Co., Ltd., to do business as manufacturers, smelters and dealers in iron, steel and other metals. The capital is placed at $50,000 and the head office of the said company will be at Montreal, Que.

Foundry in Operation.—The grey iron foundry recently completed by the Dominion Steel Products Co., Limited, Brantford, Ont., poured its first heat on June 15th, 1920, and is now proceeding with the fulfilment of orders for various classes of castings, among which are large orders for all classes of rolls for rolling mills, rubber working mills, flour mills, calender stacks and looms. This foundry can make castings up to the weight of thirty tons.

IF FOR MANUFACTURE THEN ONLY ONE TAX

Important Ruling Received at Montreal In Regard to Raw Material

Montreal.—Word was received by the secretary of the Canadian Manufacturers' Association that goods imported for use in manufacture in Canada would not be subject to the double sales tax, amounting to two per cent., but only to the importers' sale tax of one per cent. The information comes direct from George S. Taylor, Deputy Minister of Inland Revenue. This ruling has particular importance for Canadian railways, steamship companies and utilities companies, which import enormous quantities of material.

Motor Accessories & Supplies, Ltd., Kitchener, Ont., has been incorporated with a capital stock of $40,000 by Henry Sweitzer, Armand A. Schreiter, Arthur L. Sauder and others to manufacture automobile supplies, electric machines, fixtures, etc.

Classified Opportunities

POSITION WANTED

MECHANIC AND SALESMAN, AGED 35, would take European engagement for year or more. Understand metric system, French, English and Scandinavian. Prefer automotive work. Box 688, Canadian Machinery. (clm)

OPEN FOR ENGAGEMENT AS WORKS MANAGER or general superintendent. Engineer with experience on mechanical, metallurgical, experimental and development work, toolmaking and design, production work. 15 years in executive positions. Box 691, Canadian Machinery. (clm)

HELP WANTED

WANTED — MAN TO SET UP AND TAKE charge of Gleason straight tooth gear cutters. Must be able to handle men. Salary commensurate with ability and experience. Apply Employment Manager, McKinnon Industries Ltd., St. Catharines, Ont. (c26m)

DIE SINKER WANTED—FIRST-CLASS MAN only. Best working conditions and top wages. Apply Employment Manager, McKinnon Industries Limited, St. Catharines, Ont. (c26m)

SALESMAN FOR MACHINE TOOLS SUPPLIES. Must be a high grade man of engineering knowledge, and good address; for such there are excellent prospects. Address giving full particulars in confidence. Jas. Buckley Co., St. Nicholas Bldg., Montreal. (ctfm)

Foreman wanted to take charge of a department manufacturing small high-grade machines. Must be a thorough machinist and capable of handling men to get production with first-class workmanship. State experience, age and salary expected in first letter. References required. Apply Box 689, Canadian Machinery, Toronto.

IMMEDIATE DELIVERY FROM MONTREAL

50 Bars 2½" Round Cold Rolled Steel.

New stock in perfect condition

Charles P. Archibald & Co.
Machinery and Supplies
285 Beaver Hall Hill MONTREAL

FOR SALE

FROG AND SWITCH PLANER, SIZE 36" x 36" x 18', overhauled and first-class. Heavy. One Head on Rail, weight 35,000 lbs. Apply "Winnipeg," c/o Canadian Machinery. (clm)

CLEARANCE LINE—GENUINE "SLOCOMBE" Drills are offered at a sacrifice, sizes "C," "E," "F," and "G." Wholesalers and dealers will find it of interest to communicate their requirements to Box No. 692, Canadian Machinery. (ctfm)

FOR SALE—STEAM VULCANIZING KETTLE in good condition. Height, 3' 6", diameter 3' 2". Swing hinge, screwed-on top. Will hold three 37 x 5 tires. Box 693, Canadian Machinery. (c26m)

When Writing to Advertisers say you saw it in Canadian Machinery

MACHINE WORK WANTED

MACHINE WORK WANTED FOR LATHES, shapers, milling machine and planer, etc. Hourly or contract basis. Prompt delivery. W. H. Sumbling Machinery Co., Toronto. (ctfm)

MACHINERY WANTED

SMALL POWER PRESS SUITABLE FOR trimming light forgings. Apply Wheeler Needle Works, Paris, Ont. (c3m)

WANTED—VERTICAL PUNCH PRESS, 4 FT. to 5 ft. between housings, capacity about half in three-eighth. What have you?" "Winnipeg," c/o Canadian Machinery. (c26m)

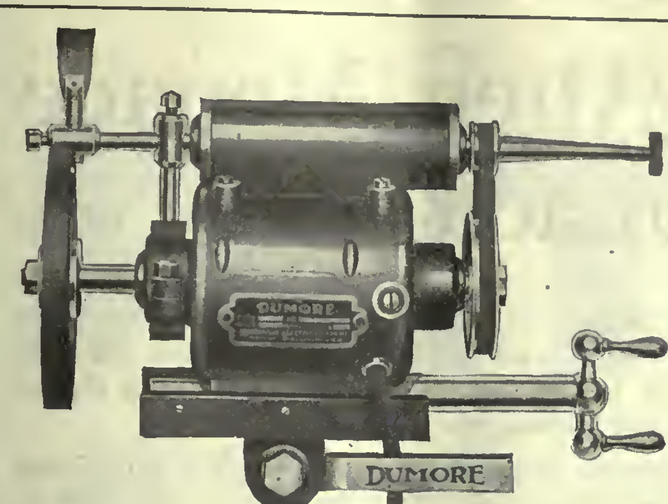
PATTERNS

TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (ctfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

Man wanted to take charge of steel department in a large manufacturing industry on production work. One who understands all kinds of forging machinery. Must be a good organizer and capable of handling men. State experience, age and salary expected. References required. Apply Box 690, Canadian Machinery, Toronto.

If what you need is not advertised, consult our Buyers' Directory and advertisers listed under proper heading.



The Parts of This Well Known Machine are Die Cast

Die Cast Parts Promote Economy

Do you require machine parts in large numbers ? If so you should decide to have the parts **die-cast.** By this method you can save a lot of expense. The making of die-cast parts is a quantity production proposition which spells **economy.** Die Cast parts require no machining; they come to you ready to assemble and they are clean and accurate.

Send us your blue prints for estimates.

DIE CASTING CHAT NO. 13.—Everyone knows of the above grinder, but do they know that every part of this grinder is a die-casting? Of course, we mean with the exception of the spindles, handles, and other parts which must be steel; but this example illustrates just to what an extent die castings can be used.

It pays to find out if a die casting can be used in your product as it means a real saving to you.

Largest Makers of Die Castings in Canada

THE FISHER MOTOR CO., LIMITED

ORILLIA, ONTARIO

MACGOVERN & COMPANY INCORPORATED POWER MACHINERY

TURBO UNITS

25 CYCLES

Generator			Turbine		Pres-
K.W.	Volts	R.P.M.	Faker	K.W.	sure.
500	370/400	1500	Westinghouse Parsons	500	150 lb.
750	440	1500	Westinghouse	750	
750	380	1500	Westinghouse Parsons	750	
850	380	1500	Westinghouse Parsons	150	150 lb.
1000	240	1500		1000	
1000	6600		Westinghouse	1000	
2000	2200	750	General Elec. Curtis	2000	150 lb.
2500	2400		Westinghouse	2500	150 lb.
2500	2200	1500	Westinghouse Parsons	2500	150 lb.
2500	2400	1500	Westinghouse	2500	150 lb.
3500	6600		General Elec.	3500	
6000	6600	1500	General Elec. Curtis	6000	170 lb.
6500	6600	750	Allis Chalmers	6500	175 lb.

MacGOVERN & COMPANY, Inc.

285 BEAVER HALL HILL, MONTRBAL

Offices: New York, Pittsburg, Seattle
Plants: Lincoln, N.J., and Linden, N.J.

Buyers and Sellers of New and Used Machinery

PARTIAL LIST OF TOOLS

2—60" Bullard Vertical Boring Mills
1—60" Niles Vertical Boring Mill
No. 4—B. & S. Plain Miller
1—86" x 86" x 8' Gray Planer, two heads
No. 3—Cincinnati Universal Miller
5—No. 0 Steptoe Hand Millers
18" x 5' 6" New Carroll-Jamieson Quick-Change Lathe
14" x 6' New Carroll-Jamieson Quick-Change Lathe
15" x 6' New Sidney D.B.G. Quick-Change Lathe, swing 17"
16" x 8' New Sidney D.B.G. Quick-Change Lathe, swing 17"
17" x 8' New National Quick-Change Lathe
3—17" x 8' New Sidney D.B.G. Quick-Change Lathe, swing 19"
17" x 10' New Sidney D.B.G. Quick-Change Lathe, swing 19"
18" x 24" New Rahn Larmon Lathe, D.B.G. Quick-Change
19" x 10' New Sidney D.B.G. Quick-Change Lathe, swing 21"
9—19" x 8' New Sidney D.B.G. Quick-Change Lathe, swing 21"
25" x 14' New Sidney D.B.C. Quick-Change Lathe, swing 27"
38" x 14' Putnam, arranged for Motor Drive
6' Western Radial Drill
5' Bickford Single Pulley Drive Radial
100-lb. New Little Giant Hammer
50-lb. New Little Giant Belt Hammer
25-lb. New Little Giant Belt Hammer
30-ton —atson & Stillman Hydraulic Press

FRANK TOOMEY INC.

27 North Third Street PHILADELPHIA, PA.

If interested tear out this page and place with letters to be answered.

The House of

PETRIE

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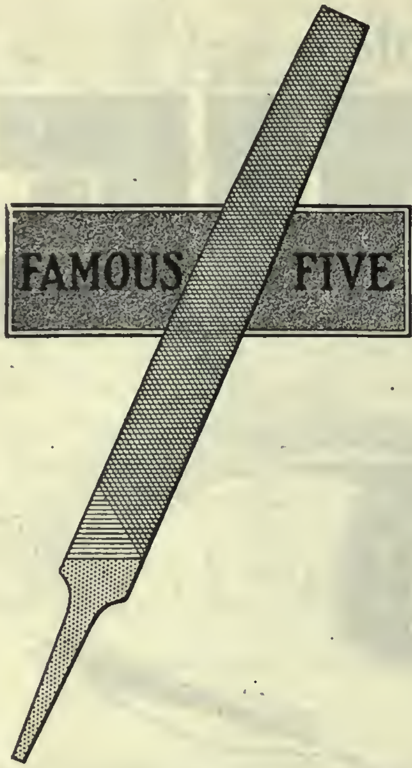

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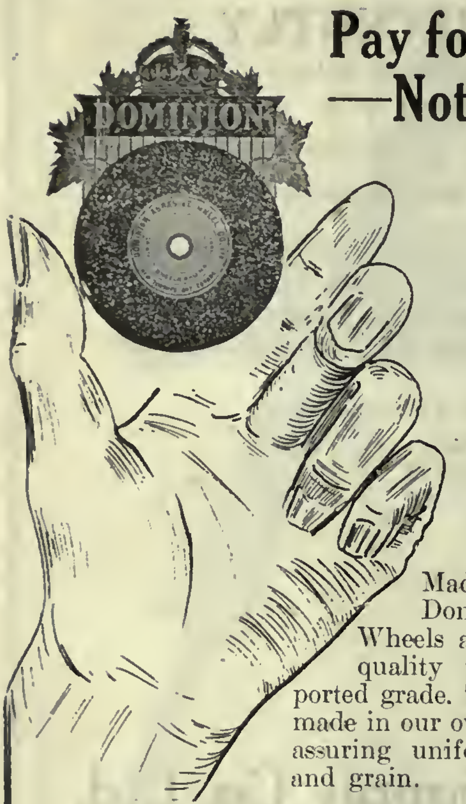

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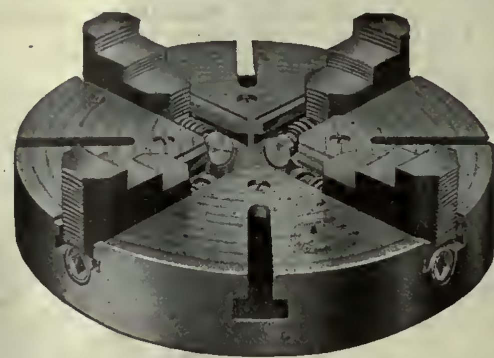

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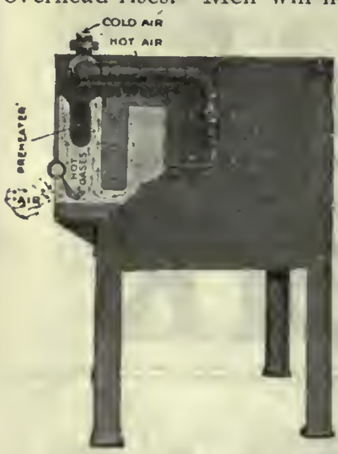

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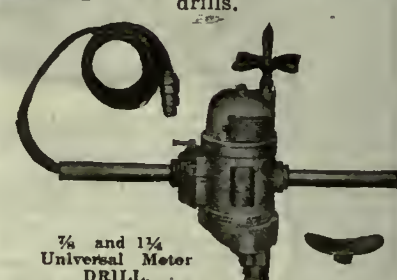

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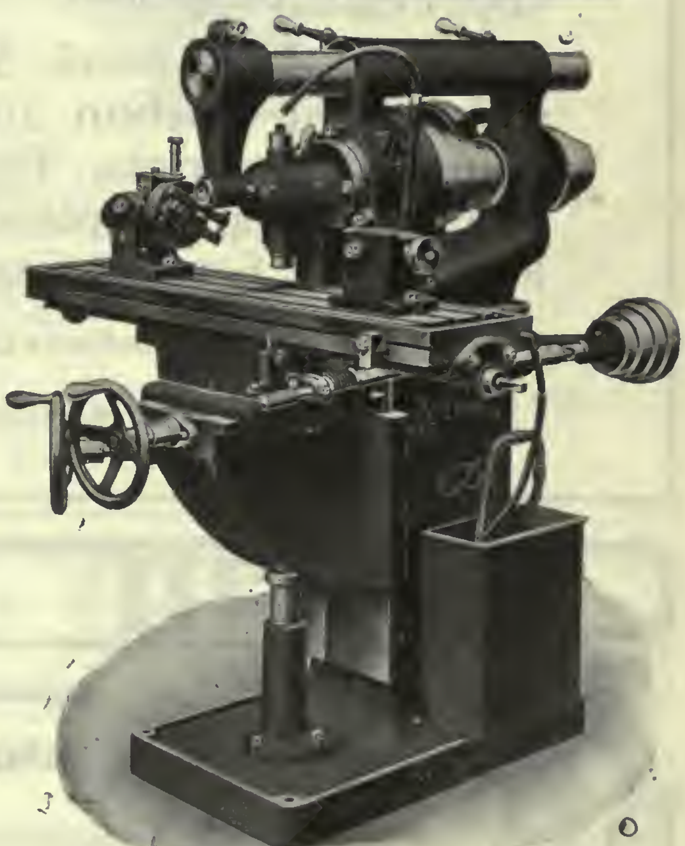

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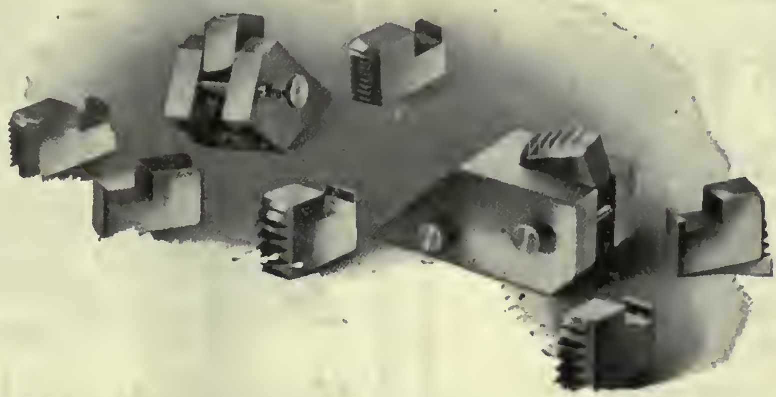

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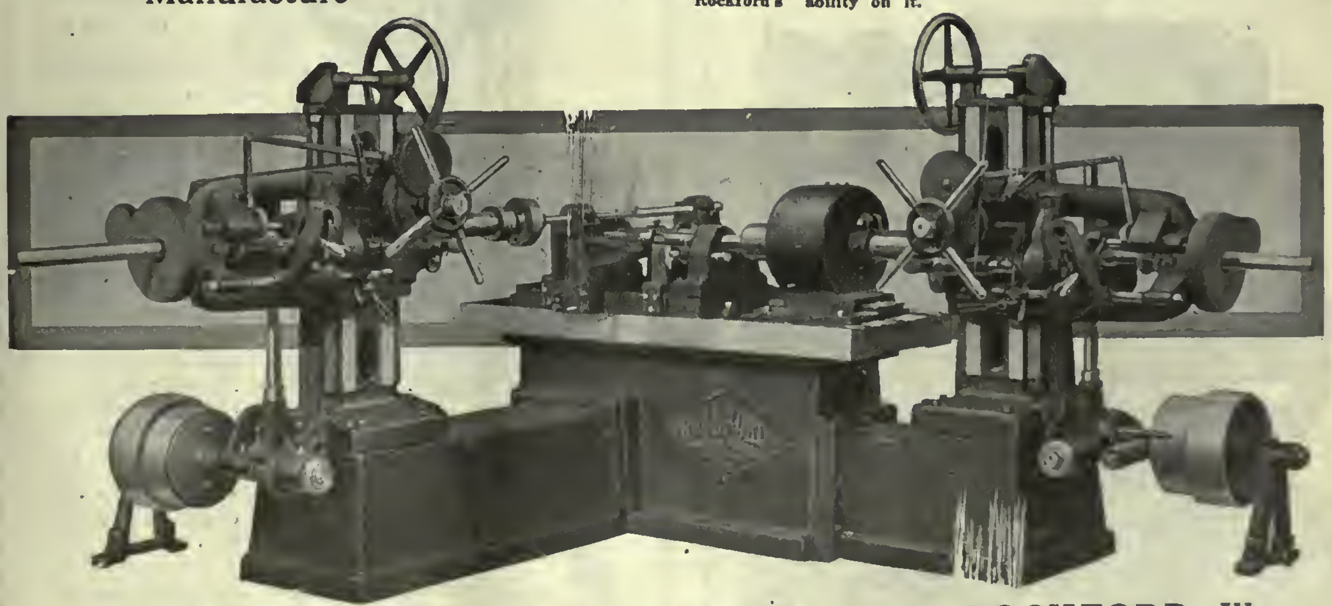

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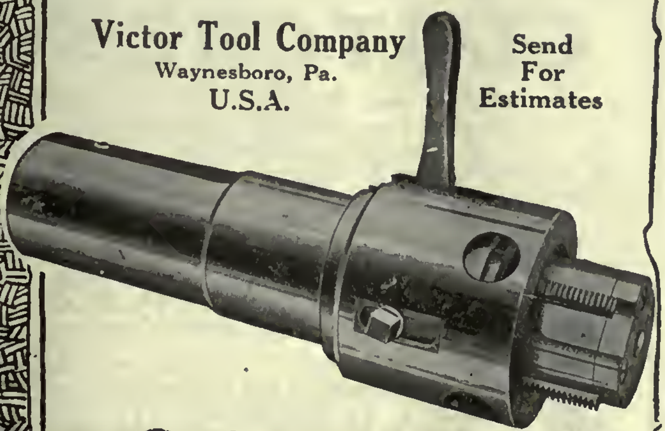

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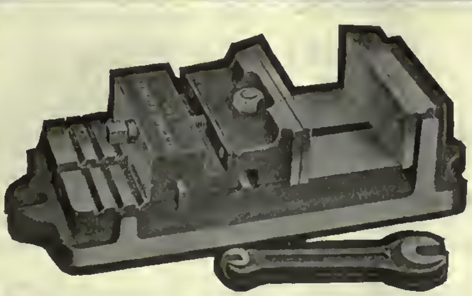

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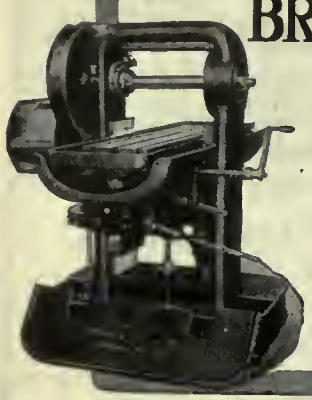

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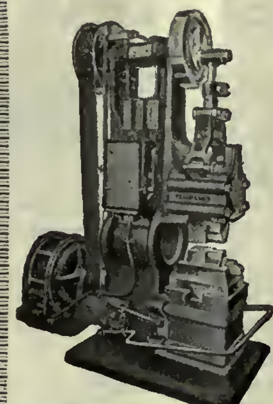

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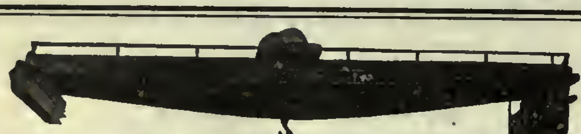

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Gutta Perche & Rubber, Ltd., Toronto.

BELTING, HAIR
Summer & Co., New York, N.Y.

BELTING, LEATHER
Can. Graton & Knight Mfg. Co., Montreal
Gutta Percha & Rubber, Ltd., Toronto, Canada.
Sumner & Co., New York, N. Y.
John Tullis & Son, Glasgow, Scotland.

BELTING, RUBBER
International Mchy. Spls., Ltd., Montreal.
Quaker City Rubber Co, Philadelphia, Pa.

BELTING, STITCHED COTTON DUCK
Dominion Belting Co., Hamilton, Ont.
Gutta Percha & Rubber, Ltd., Toronto.

BELTING, WOVEN
Federal Engineering Co., Ltd., Toronto
Summer & Co., New York, N.Y.

BENDING MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.
Bertram & Sons Co., John, Dundas
Brown-Boggs Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Kitchener.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Mach. Co., Toronto.
Petrie, Ltd., H. W., Toronto.

BLAST GATES
W. S. Rockwell Co., New York, N.Y.

BLASTING MACHINES, SAND
Garlock-Walker Machinery Co., Toronto
Jardine, A. B., & Co., Hespeler, Ont.
National Mach. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

BILLET MARKERS
Matthews & Co., Jas. H., Pittsburgh, Pa.

BILLETS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Swedish Steel & Importing Co., Ltd., Montreal.
Algoma Steel Corp., Sault Ste. Marie.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
United States Steel Corp., Canton, Ohio.

BILLETS, FORGING
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.

BINS, STEEL
Dennis Wire & Iron Works, London, Ont.
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Toronto Iron Works, Ltd., Toronto, Ont.
William Hamilton Co., Peterboro, Ont.

BLACKSMITH WORK
The Thos. Pink Co., Ltd., Pembroke.

BLOCKS, CHAIN
Oliver Engineering Co., Montreal.

BLOOMS AND SLABS
Algoma Steel Corp., Sault Ste. Marie
United States Steel Corp., Canton, Ohio.

BLOWERS
Can. Blower & Forge Co., Kitchener, Ont.
Garlock-Walker Machinery Co., Toronto.
MacGovern & Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
U.S. Ordnance, Toronto, Ont.

BLOWING ENGINES
General Combustion Co., Ltd., Montreal, Que.

BLOW PIPES AND REGULATORS
Carter Welding Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

BLUE PRINTING MACHINERY
Commercial Camera Co., Providence, R.I.

BLUE PRINT PAPER
Hughes, Owens Co., Ltd., Montreal, Que.

BOARDS, GLASS CUTTING
Lufkin Rule Co., of Can., Windsor, Ont.

BOARTZ
Joyce, Koebel & Co., Inc., New York.

BOLT CUTTERS
Greenfield Tap & Die Corp., Greenfield, Mass.

BOILER TUBES
Lyman Tube & Supply Co., Montreal, Que.

BOILER BREECHINGS
Que.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
St Lawrence Welding Co., Ltd., Montreal.
William Hamilton Co., Peterboro, Ont.

BOLT CUTTERS
Fellows Gear Shaper Co., Springfield, Vt.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros., of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.

BOILERS, RANGE
Can. John Wood Mfg. Co., Ltd., Toronto Ont.

BOILERS
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.

BOLT CUTTERS AND NUT TAPERS
Aikenhead Hardware Co., Toronto, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Landis Machine Co., Waynesboro, Pa.
A.B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros. Co. of Canada, Galt, Ont.
Petrie, Ltd., H. W., Toronto

BOLTS
Aikenhead Hardware Co., Toronto, Ont.
London Bolt & Hinge Wks., London, Ont.
Morrow Screw & Nut Co., John, Ingersoll.
Rice, Lewis & Son, Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton, Ont.
Williams & Co., J. H. Brooklyn, N.Y.

BOLTS, COUPLING
Galt Machine Screw Co., Ltd., Galt, Ont.

BOLTS, STAY
Morrow Screw & Nut Co., John, Ingersoll.

BOLTS, SPRING SHAKLE
Can. Winkley Co., Ltd., Windsor, Ont.
Morrow Screw & Nut Co., John, Ingersoll

BOLTS, PATCH
Morrow Screw & Nut Co., John, Ingersoll.

BOLT AND NUT MACHINERY
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas, Ont
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto
Gardner & Son, Robt., Montreal.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Universal Mach. Co., Bowling Green, O.
Williams Machinery Co., A. R., Toronto

BOLT THREADING MACHINERY
Jardine & Co., Ltd., B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
Victor Tool Co., Waynesboro, Pa.

BONDING MACHINES (Electric Railway)
The Lincoln Electric Co., Toronto, Ont.

BORING MACHINES, PNEUMATIC CYLINDER
Cleveland Pneumatic Tool Co., Toronto.
Canadian Fairbanks-Morse Co., Montreal
Can. Ingersoll-Rand Co., Sherbrooke Que
Garlock-Walker Mach. Co., Toronto.

BORING MACHINES, UPRIGHT AND HORIZONTAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto
Oliver Mach'y Co., Grand Rapids, Mich.
Gisholt Machine Co., Madison, Wis.
Hoefer Mfg. Co., Freeport, Ill.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Rockford Drilling Mchs. Co., Rockford, Ill

BORING AND TURNING MILLS
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Foss Mch. & S'ply Co., Geo. F., Montreal
Knight Metal Products, Toronto.
Oliver Mach. Co., Grand Rapids, Mich.
Niles-Bement-Pond Co., New York.

BOXES, CAST IRON
Brown & Sharpe Mfg. Co., Providence, R.I.

BOXES, STEEL SHOP AND TOTE
Cleveland Wire Spring Co., Cleveland.

BRAKES
Brown, Boggs & Co., Hamilton, Can.
Electric Steel & Metals, Ltd., Welland.

BRASS—SHEETS, ROLLS, PLATES, and RODS
Brown's Copper and Brass Rolling Mills, New Toronto.

BRASS ALLOYS
British Smelting & Refining Co., Ltd., Montreal, Que.

BRASS AND COPPER TUBING
Lyman Tube & Supply Co., Montreal, Que.

BRASS FOUNDERS
Canada Metal Co., Toronto.
St. Lawrence Welding Co., Montreal.
Tallman Brass & Metal Co., Hamilton.

BRASS GOODS
Crane, Ltd., Montreal, Que.

BRASS PIPE AND TUBE
Crane, Ltd., Montreal, Que.

BRASS WORKING MACHINERY
Barber Mchy. Co., Ltd., Toronto, Ont.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machinery Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Prest-O-Lite Co., Inc., Toronto, Ont.
Wood Turret Machine Co., Brazil, Ind.
Williams Machy. Co., A. R., Toronto.
Brown's Copper and Brass Rolling Mills, New Toronto.

BRAZING EQUIPMENT
Chicago Flexible Shaft Co., Chicago, Ill.

BRICKS, FIRE
Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

BRIDGES, RLY. AND HIGHWAY
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.

BRONZE—SHEETS, ROLLS, PLATES, and RODS
Brown's Copper and Brass Rolling Mills, New Toronto.

BRONZE, NAVAL
Canada Metal Co., Toronto.
Tallman Brass and Metal Co., Hamilton.

BRONZE COPPER
Canada Metal Co., Toronto.

BRUSHES, CARBON
Lyman Tube & Supply Co., Montreal, Que.

BUFFING AND POLISHING MACHINERY
Ford-Smith Mach. Co., Hamilton.
Foss Mchy. & S'ply Co., Geo. F. Montreal
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.

BUCKETS, DUMP
MacKinnon Steel Co., Sherbroooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
St Lawrence Welding Co, Ltd, Montreal

BUCKETS, ELEVATOR
Can. Link-Belt Co., Toronto, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co. Ltd., Montreal

BUCKETS, CLAM SHELL, CRAB, DUMP
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Ltd, Walkerville.

BULLDOZERS
Bertram & Sons Co., John, Dundas.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

BURNERS, OIL AND NATURAL GAS
Northern Crane Works, Ltd., Walkerville.
W. S. Rockwell Co., New York, N.Y.

BURRS, IRON AND COPPER
Parmenter & Bulloch Co., Gananoque.

BUSHINGS, BRONZE
Morrow Screw & Nut Co., John, Ingersoll.
St Lawrence Welding Co, Ltd., Montreal

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R.I.
Pangborn Corporation, Hagerstown, Md.

CABINETS, SAND BLAST
Pangborn Corporation, Hagerstown, Md.

CABLE, ELECTRIC
International Machinery & Supply Co., Ltd., Montreal, Que.

CABLES, TRANSMISSION AND TELEPHONES
Northern Electric Co., Ltd., Montreal.

CALKS, BOOT
Lufkin Rule Co., of Can., Windsor, Ont.

CANNERS' MACHINERY
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Can.

CANNERS' CONVEYORS
Can. Link-Belt Co., Toronto, Ont.

CARBIDE
Carter Welding Co., Ltd., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.
Union Carbide Co., of Canada, Limited, Weland, nt.

CARBONIZING BOXES
Can. Driver-Harris Co., Ltd., Walkerville
Katie Foundry, Galt, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
Swedish Crucible Steel Co., Windsor.

CARRIERS, PNEUMATIC TUBE
Jones & Glassco, Montreal.

CARS, INDUSTRIAL
Can. Blower & Forge Co., Kitchener, Ont
Can. Fairbanks-Morse Co., Ltd, Montreal
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

CASES, FILING
Economy Drawing Table Co., Adrian, Mich.

CASTINGS, ALUMINUM, BRASS BRONZE, COPPER, AND GUN METAL
Algoma Steel Corp., Sault Ste. Marie.
Franklin Mfg. Co., Syracuse, N.Y.
Canada Metal Co., Ltd., Toronto, Ont.

CASTINGS, DIE CAST
Canada Metal Co., Ltd., Toronto, Ont.
Franklin Mfg. Co., Syracuse, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Tallman Brass & Metals Ltd., Hamilton, Ont.

CASTINGS, STEEL—ALL KINDS
Canada Electric Castings, Ltd., Orillia, Ont.
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Electric Steel & Metals Co., Welland.
Mesta Machine Co., Pittsburgh, Pa.

CASTINGS, ELECTRIC AND ALLOY STEEL
Can. Elec. Castings Co. Ltd., Orillia, Ont
Dominion Foundries & Steel Ltd., Hamilton, Ont.

CARRIERS COUPLING BOLTS
John Morrow Screw & Nut Co., Ingersoll
Alexander Fleck Ltd., Ottawa.
Tallman Brass & Metal Co., Hamilton.

CASTINGS, BENCH LEG.
Brown & Sharpe Mfg. Co., Providence, R.I.

CASTINGS, BRASS AND IRON
Algoma Steel Corp., Sault Ste. Marie.
International Machinery and Supply Co., Ltd., Montreal, Que.

CASTINGS, BUILDING
Katie Foundry, Galt, Ont.

CASTINGS, GRAY IRON
Bernard Industrial Co., A., Fortierville, Q.
Brown & Sharpe Mfg. Co., Providence, R.I.
Brown, Boggs Co., Ltd., Hamilton.
Can. Elec. Castings Co, Ltd., Orillia, Ont
Alexander Fleck, Ltd., Ottawa.
Gardner & Son, Robt., Montreal.
Hull Iron & Steel Foundries, Ltd., Hull
International Malleable Iron Co., Guelph
Kennedy & Sons, Ltd., Wm., Owen Sound.
Katie Foundry, Ltd., Galt, Ont.
Hamilton Co., Wm., Peterboro.
McFarlane Engineering Ltd., G. W., Paris, Ont.

CASTINGS, PLUMBERS'
Katie Foundry, Galt, Ont.

CASTINGS, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville

CASTINGS, HARDWARE
Katie Foundry, Galt, Ont.

CASTINGS, STEEL CHROME AND MANGANESE STEEL
Thos. Davidson Mfg. Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hull Iron & Steel Foundries, Ltd., Hull.
Kennedy & Sons, Ltd, Owen Sound.

CASTINGS, MALLEABLE
International Malleable Iron Co., Guelph

CASTINGS, NICKEL STEEL
Hull Iron & Steel Foundries, Ltd., Hull.

CEMENT MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gardner, Robt., & Son, Montreal.

CEMENT HANDLING MACHINERY
Can. Link-Belt Co., Toronto, Ont.

CEMENT TOOLS
Atkins & Co., E. C., Hamilton, Ont.

CENTERING MACHINES
Victoria Foundry Co., Ottawa, Ont.

CENTRE REAMERS
Bertram & Sons Co., John, Dundas.
Butterfield & Co., Inc., Rock Island, Que.
Gardner, Robt. & Son, Montreal.
Hurlburt, Rogers Mch. Co., South Sudbury, Mass.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co., of Canada, Galt, Ont.

CHAIN, WELDED COIL
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

CHAIN BLOCKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford Chain Block & Mfg. Co., Phila., Pa.
Garlock-Walker Machy. Co., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & HoistCo., Herbert, Niagara Falls, Ont.
Oliver Engineering Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Jones & Glassco, Montreal, Que.

CHAINS, AGRICULTURAL
Canadian Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.

CHAINS, AUTOMOBILE ENGINE
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.

CHAINS, BICYCLE, DRIVE AND BLOCK
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAINS, FOR ELEVATORS AND CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAIN, MALLEABLE, DETACHABLE AND RIVETED
Can. Link-Belt Co., Toronto, Ont.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAINS, POWER TRANSMISSION
Canadian Link-Belt Co., Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, New York.
Glasgow, N.S.

CHAINS, SPROCKET WHEEL
Can. Link-Belt Co., Ltd., Toronto, Ont.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAIN DRIVES
Can. Link-Belt Co., Toronto, Ont.
Coventry Chain Co., Coventry, England.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHASERS
National Acme Co., Cleveland, Ohio.
Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont.

CHEMISTS
Toronto Testing Lab'tory, Ltd., Toronto

CHUCKS, AERO, AUTOMATIC
Garvin Machine Co., New York.

CHUCKS, CENTERING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKS, COLLET, AIR
Elliott & Whitehall Mach. & Tool Co. Galt, Ont.
Smalley-General Co., Inc., Bay City, Mich.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, LATHE AND UNIVERSAL
Aikenhead Hardware Co., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt., & Son, Montreal.
Garlock-Walker Mach'y Co., Toronto.
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Chicago, Ill.
Jacobs Mfg. Co., Hartford, Conn.
Ker & Goodwin Machine Co., Ltd.
Knight Metal Products, Toronto.
Modern Tool Co., Erie, Pa.
Rice Lewis & Son, Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, AUTOMATIC AND KEYLESS
Aikenhead Hardware Co., Toronto, Ont
Can. Blower & Forge Co., Kitchener.
McCrosky Tool Corp., Meadville, Pa., U. S. A.

CHUCKS, FRICTION AND TAP
Victor Tool Co., Waynesboro, Pa.

CHUCKS, MAGNETIC
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

CHUCKS, RING WHEEL
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.

CHUCKS, WHEEL, CAR
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKING MACHINES
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Windsor, Vt.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Wood Turret Mach. Co., Brazil, Ind.
Williams Mchy Co., A. R., Toronto, Ont.

CIRCULATING SYSTEMS FOR LUBRICATING OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

CLAY FIRE
Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

CLEANERS, METER, WASTE, GENERAL
Oakley Chemical Co., New York, N.Y.

CLEANING COMPOUND
Oakley Chemical Co., New York.

CLOCK SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

CLOCKS, WATCHMAN, PORTABLE
Gisholt Machine Co., Madison, Wis.

CLOSETS
Crane, Ltd., Montreal, Que.

CLUTCHES, CHAIN
Wright Mfg. Co., Lisbon, Ohio.

CLUTCHES, FRICTION AND PULLEY
Bernard Industrial Co., A., Fortierville, Q
Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mach. Co., Manchester, Conn.
Positive Clutch & Pulley Wks., Aurora Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.

COAL CRUSHERS
Canadian Link-Belt Co., Ltd., Toronto, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Que.

COAL HANDLING MACHINERY
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Nova Scotia Steel & Coal Co., New

COLD ROLLED STRIP, ALL METAL

COLLARS, SHAFTING
Can. Driver-Harris Co., Ltd., Walkerville.
Williams & Co., J. H., Brooklyn, N.Y.

COLLECTORS, PNEUMATIC
Can. Blower & Forge Co., Kitchener.
Sturtevant Co., B. F., Galt, Ont.

COLLETS
Becker Milling Machine Co., Boston.

COMPOSITION INGOT
Canada Metal Co., Toronto, Ont.

COMPOUNDS, CUTTING AND GRINDING, DRAWING, STAMPING
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR
Atkins & Co., E. C., Hamilton, Ont.
Can. Ingersoll-Rand Co., Sherbrooke.
Cleveland Pneumatic Tool Co., Toronto.
Curtis Pneumatic Machy. Co., St. Louis
Elliott & Whitehall, Galt, Ont.
Garlock-Walker Machy. Co., Toronto.
MacGovern & Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Superior Machinery Co., London, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

CONDENSERS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
MacGovern & Co., Montreal, Que.
Smalley-General Co., Inc., Bay City Mich.

CONDUITS
Northern Electric Co., Ltd., Montreal Que

CONNECTING RODS
Canada Found's & Forgings, Ltd., Welland, Ont.

CONNECTING ROD CUTTERS INTERCHANGEABLE
Eclipse Counterbore Co. Ltd., Walkerville, Ont.

CONTRACTORS' HOISTS
Canadian Mead-Morrison Co., Limited, Montreal, Que.

CONTRACT WORK
Brown Engineering Corp., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.
Globe Engineering Co., Hamilton, Ont.
Homer & Wilson, Hamilton, Ont.
Katie Foundry, Ltd., Galt, Ont.
Victoria Foundry Co., Ottawa.

CONTROLLERS, MAGNETIC BRAKES, ELEC. WINCHES, MONO RAIL HOISTS
Volta Mfg. Co., Welland, Ont.

CONTROLLERS AND STARTERS
Williams Mach'y Co., A. R., Toronto.

CONTROLLING INSTRUMENTS
Taylor Instrument Co., Rochester, N.Y.

CONVERTERS, ROTARY
MacGovern & Co., Montreal, Que.
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.

CONVEYORS—McCASLIN GRAVITY BUCKET
Canadian Mead-Morrison Co., Limited, Montreal, Que.

COOLERS, WITH DRINKING FOUNTAINS
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

COPING MACHINES
Bertram & Sons Co., John, Dundas, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Can. Blower & Forge Co., Kitchener.

COPPER, BUS BAR, SHEET, PATES, RODS
British Smelting & Refining Co., Ltd., Montreal, Que.
Brown's Copper and Brass Rolling Mills, New Toronto.
Brown's Copper and Brass Rolling Mills, New Toronto.

CORE OIL
Swan & Finch, Inc., 165 Broadway.

COUNTERBORES AND COUNTERSINKS
Aikenhead Hardware Co., Toronto, Ont.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.

COUNTERSINKS, INTERCHANGEABLE
Eclipse Counterbore Co., Ltd., Walkerville, Ont.

COUNTERBORES, INVERTED, INTERCHANGEABLE
Eclipse Counterbore Co., Ltd., Walkerville, Ont.

COUNTERSHAFTS
Almond Mfg. Co., Ashburnham, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Gray Ball Bearing Co., Ltd., Toronto.
Baird Machine Co., Bridgeport, Conn.
Ford-Smith Machine Co., Hamilton, Ont.
Foster Machine Co., Elkhart, Ind.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal
Williams Mchy Co., A. R., Toronto, Ont.

COUPLINGS, FRICTION
Bernard Industrial Co., The A., Fortierville, Que.
Can. Link-Belt Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

COUPLINGS, RAPID HOSE
Int. Machinery & Supply Co., Ltd., Montreal, Que.

COILING MACHINERY, WIRE AND SPRING
Garlock-Walker Machinery Co., Toronto.

COKE AND COAL
Hanna & Co., M. A., Cleveland, O.

COUPLINGS, PLAIN, FLEXIBLE AND CUT OFF
Cleveland Pneumatic Tool Co., of Canada, Toronto.

CRANES, OVERHEAD, HAND AND
Gardner, Robt. & Son, Montreal.
Independent Pneumatic Tool Co., Chicago

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.
Northern Crane Works, Walkerville.

ELECTRIC
Volta Manufacturing Co., Welland, Ont.

CUPS, OIL
Can. Winkley Co., Ltd., Windsor, Ont.

COVERS, OIL HOLE
Can. Winkley Co., Ltd., Windsor, Ont.

CRANES, GANTRY
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.

CRANE RUNWAYS
MacKinnon Steel Co., Sherbrooke, Que.

CRANES, JIB
Brown Hoisting Machinery Co., Cleveland, Ohio.

CRANES, LOCOMOTIVE
Brown Hoisting Machinery Co., Cleveland, Ohio.

CRANES, GOLIATH, PNEUMATIC AND PORTABLE
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Morris Crane and Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Petrie, Ltd., H. W., Toronto.

CRANES, PILLAR
Brown Hoisting Machinery Co., Cleveland, Ohio.

CRANES, TRAVELLING, ELECTRIC AND HAND POWER
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machy. Co., St. Louis.
Dominion Bridge Co., Montreal.
Hepburn, John T., Ltd., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Niles-Bement-Pond Co., New York.
Northern Crane Works, Walkerville.
Oliver Engineering Co., Montreal.

CRANK SHAFTS
Canada Found's & Forgings Ltd., Welland
Williams & Co., J. H., Brooklyn, N.Y.

CRANES, PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Brown Hoisting Machinery Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CRIMPS, LEATHER
Graton & Knight Mfg. Co., Worcester, Mass.

CRUSHERS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Elec. Steel & Metals, Welland, Ont.

CUPOLAS
Can. Blower & Forge Co., Kitchener.
Northern Crane Works, Walkerville.

CURB PUMPS FOR OIL, GASOLINE
Bowser Co., Ltd., S. F., Toronto, Ont.

CURRENT TRANSFORMERS
Volta Manufacturing Co., Welland, Ont.

CUT-OFF COUPLINGS, FRICTION
Petrie, Ltd., H. W., Toronto.

CUTTERS, BOLT
See Bolt Cutters.

CUTTERS, GEARS
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Fellows Gear Shaper Co., Springfield, Vt.

CUTTERS, FLUE
Cleveland Pneumatic Tool Co., Toronto.

CUTTER HEADS
Oliver Machinery Co., Grand Rapids, Mich

CUTTERS, PIPE (See Pipe Cutters)

CUTTERS, MILLING
Becker Milling Mach. Co., Boston, Mass.
Butterfield & Co., Rock Island, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cleveland Twist Drill Co., Cleveland.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Illinois Tool Works, Chicago, Ill.
Ingersoll Mache. Co., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Toronto, Ont.

Tabor Mfg. Co., Philadelphia, Pa.
Whitney Mfg. Co., Hartford, Conn.
Wilt Twist Drill Co., Walkerville, Ont.

CUTTER RELIEVING MACHINES
Cleveland Milling Machine Co., Cleveland.

CUTTING-OFF MACHINES
Armstrong Bros., Tool Co., Chicago.
Atkins & Co., E. C., Hamilton, Ont.
Bertram & Sons Co., John, Dundas.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Foss Mchy & S'ply Co., Geo. F., Montreal
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hurlburt, Rogers Machy. Co., South Sudbury, Mass.
Hall & Sons, John H., Brantford, Ont.
Kennedy & Sons, Wm., Owen Sound.
Lyman Tube & Supply Co., Montreal, Que.
Niles-Bement-Pond Co., New York, N.Y.
Prest-O-Lite Co., Inc., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Tabor Mfg. Co., Philadelphia, Pa.
Wells Bros. of Can., Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

CUTTING COMPOUND AND CUTTING OIL
Cataract Refining Co., Ltd., Toronto.
Swan & Finch, Inc., New York.

CUTTING OIL, RECLAIMING SYSTEM
Bowser Co., Ltd., S. F., Toronto, Ont.

CUTTING AND WELDING PLANTS
Davis-Bournonville Co., Jersey City, N.J.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

CYANIDE AND LEAD BATH POTS
Swedish Crucible Steel Co., Windsor.

CYLINDERS, AIR
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Smalley General Co., Inc., Bay City, Mich

CYLINDERS, AUTOMATIC REBORING JIGS AND REAMERS
Kelley Reamer Co., Cleveland, O.

DEHUMIDIFYING
B. F. Sturtevant Co., Galt, Ont.

DERRICKS
Aikenhead Hardware Co., Toronto, Ont.
Dominion Bridge Co., Montreal.
Hepburn Co., Ltd., J. T., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

DERRICK HOISTS
Canadian Mead-Morrison Co., Limited, Montreal, Que.

DIAMOND (BORTZ)
Furniss, Clarke & Co., Montreal, Que.

DIAMOND TOOLS
Ford-Smith Machine Co., Hamilton, Ont.
Furniss, Clarke & Co., Montreal, Que.
Joyce-Koebel Co., Inc., New York City.
Wheel Trueing Tool Co., Detroit.
Petrie, Ltd., H. W., Toronto.

DIAMONDS, CARBON AND BORTZ
Wheel Trueing Tool Co., Detroit.

DIAMONDS, BLACK AND ROUGH
Joyce, Koebel & Co., Inc., New York.
Wheel Trueing Tool Co., Windsor, Ont.

DIE CASTINGS
Fisher Motor Co., Ltd., Orillia, Ont.
Tallman Brass & Metals Ltd., Hamilton, Ont.

DIE HEADS, AUTOMATIC
Greenfield Tap & Die Corp., Greenfield Mass.
Wells Bros. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.

DIES, BRASS PRINTING, EMBOSSING AND LETTERING
Matthews, Jas. H., & Co., Pittsburgh, Pa.

DIES FOR BIT BRACE USE
Butterfield & Co., Rock Island, Que.
Crescent Mche. Co., Ltd., Montreal, P.Q.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Wells Brothers Co., of Canada, Galt.

DIES AND DIE STOCKS
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Rock Island, Que.
Brown, Boggs Co., Hamilton, Ont.
Crescent Mche. Co., Ltd., Montreal, P.Q.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt. & Son, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Jones & Lamson, Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
Marshall, Son & Bunney, Toronto.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Rickert-Shafer Co., Erie, Pa.
Stoll Co., Inc., D. H., Buffalo, N.Y.
Wells Brothers of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DIES, HAMMERED
Kimber & Hillier Mfg., Co., St. Catharines, Ont.

DIES, DROP FORGE.
Kimber & Hillier Mfg., Co., St. Catharines, Ont.

DIES, METAL STAMPING
Crescent Mche. Co., Ltd., Montreal, P.Q.
Elliott & Whitehall, Galt, Ont.

DIES, PIPE THREADING
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Crescent Mche Co., Ltd., Montreal, P.Q.
Landis Machine Co., Waynesboro, Pa.

DIES, THREADING
Butterfield & Co., Inc., Rock Island, Que.
Crescent Machine Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

DIE SINKERS
Becker Milling Machine Co., Boston
Garvin Machine Co., New York.
Kimber & Hillier Mfg., Co., St. Catharines, Ont.
Pratt & Whitney Co., Dundas, Ont.
Walcott Lathe Co., Jackson, Mich

DIES FOR MACHINES
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Rock Island, Que.
Firth & Sons, Thos., Montreal, Que.
Landis Machine Co., Waynesboro, Pa.
Wells Brothers Co. of Canada, Galt.

DIE HEADS
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Canada, Galt, Ont.

DIES, SELF-OPENING
Geometric Tool Co., New Haven.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Wells Brothers Co. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.

DIE FILING MACHINES
Oliver Mach. Co., Grand Rapids, Mich.

DIE STEEL, HOT AND COLD WORK
Armstrong-Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.

DIES FOR SCREW PLATES
Butterfield & Co., Inc., Rock Island, Que.
Wells Bros. Co. of Can., Galt, Ont.

DIES, SHEET METAL WORKING
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada
Globe Engineering Co., Hamilton, Ont.
Stoll Co., D. H., Buffalo, N.Y.

DIES, SCREW AND THREAD
Butterfield & Co., Rock Island, Que.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
National-Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros., Co., of Can., Galt, Ont

DISCS, LEATHER, STEEL
Graton & Knight Mfg. Co., Worcester, Mass.
Swedish Steel & Importing Co., Montreal

DIRECT CONNECTED UNITS
MacGovern & Co., Montreal, Que.

DRAFT, MECHANICAL
Butterfield & Co., Rock Island, Que.
Can. Blower & Forge Co., Kitchener.
A. B. Jardine & Co., Hespeler, Ont.
Pratt & Whitney Co., Dundas, Ont.
Sturtevant Co., B. F., Galt, Ont.

DRAINAGE FITTINGS
Crane, Ltd., Montreal, Que.

DRAWING INSTRUMENTS
Hughes, Owens Co., Ltd., Montreal, Que.

DRAWING OFFICE SUPPLIES
Hughes, Owens Co., Ltd., Montreal, Que.

DRESSERS, GRINDING AND EMERY WHEEL
Atkins & Co., E. C., Hamilton, Ont.
Can. Desmond-Stephan Mfg. Co., Hamilton
Dominion Abrasive Co., Ltd., Mimico, Ont
Petrie, Ltd., H. W., Toronto.
Wheel Trueing Tool Co., Windsor, Ont.

DRILL PRESSES
Aurora Tool Works, Aurora, Ind.
Barber Mchy. Co., Ltd., Toronto, Ont.
W. F. & John Barnes Co., Rockford.
Can. Blower & Forge Co., Kitchener.
Canada Machinery Corp., Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal
Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
U. S. Mach. Tool Co., Cincinnati, Ohio.
A. R. Williams Machinery Co., Toronto.

DRILL RODS
Atkins & Co., Ltd., Wm., Sheffield, Eng
Kayser-Ellison & Co., Ltd., Montreal.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
Marshall, Son & Bunney, Toronto.
Swedish Steel & Importing Co., Ltd., Montreal.

DRILLING MACHINES, GANG
Barnes, W. F. & John, Co., Rockford, Ill.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bilton Mach. Tool Co., Bridgeport, Conn
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Silver Mfg. Co., Salem, Ohio.

DRILLING MACHINES, LOCOMOTIVE AND MULTIPLE SPINDLE
Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons Co., Dundas.
Bilton Mach. Tool Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Mach. Co., Toronto.
Garvin Machine Co., New York.
Hoefer Mfg., Co., Freeport, Ill.
Henry & Wright Mfg. Co., Hartford, Conn
A. B. Jardine & Co., Hespeler, Ont.
Landis Tool Co., Waynesboro, Pa.
Nat. Automatic Tool Co., Richmond, Ind.
Niles-Bement-Pond Co., New York.
Rockford Drilling Mach Co., Rockford, Ill

DRILLING MACHINES, RADIAL AND TURRET
Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons Co., Dundas.
Canadian Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Henry & Wright Mfg. Co., Hartford.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLING MACHINES, SENSITIVE
Barber Mchy. Co., Ltd., Toronto, Ont.
Bilton Mach. Tool Co., Bridgeport, Conn.
W. F. & John Barnes Co., Rockford, Ill.
Canadian Fairbanks-Morse Co., Montreal.
Canadian Machinery Corp., Galt, Ont.
Geo. F. Foss Mch. & S'ply Co., Montreal.
Garlock-Walker Mach. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
United States Mach. Tool Co., Cincinnati.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLING MACHINES, UPRIGHT AND HORIZONTAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Aurora Tool Works, Aurora, Ind.
John Bertram & Sons Co., Dundas.
Garlock-Walker Mach. Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener.
Canada Mach. Corp., Galt, Ont.
Garvin Machine Co., New York.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mach. Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
A. B. Jardine & Co., Hespeler, Ont.
Knight Metal Products, Toronto.
Landis Tool Co., Waynesboro, Pa.
R. McDougall Co., Galt.
Nat. Automatic Tool Co., Richmond, Ind.
Rockford Drilling Mach. Co., Rockford, Ill.
Niles-Bement-Pond Co., New York.
Silver Mfg. Co., Salem, Ohio.
A. R. Williams Machinery Co., Toronto.

DRILLING MACHINES, SPECIAL
Hoefer Mfg. Co., Freeport, Ill.

DRILLING POSTS
Aikenhead Hardware Co., Toronto, Ont.
Keystone Mfg. Co., Buffalo, N.Y.
Rice Lewis & Son, Toronto, Ont.
Silver Mfg. Co., Salem, Ohio.

DRILLS, BENCH
Aikenhead Hardware Co., Toronto.
W. F. & John Barnes Co., Rockford, Ill.
Can. Blower & Forge Co., Kitchener.
Can. Fairbanks-Morse Co., Montreal.
Geo. F. Foss Mch. & S'ply Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

DRILLS, BLACKSMITH AND BIT STOCK
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Can. Blower & Forge Co., Kitchener.
Cleveland Twist Drill Co., Cleveland.
Geo. F. Foss Mch. & S'ply Co., Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.
Whitman & Barnes Mfg. Co., Akron, O.
Wilkinson & Kompass, Hamilton, Ont.
Wilt Twist Drill Co. of Can., Walkerville.

DRILLS, CENTRE
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Morrow Screw & Nut Co., John, Ingersoll.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto.
Rice Lewis & Son, Toronto, Ont.
Wilt Twist Drill Co., of Can., Walkerville.

DRILLS CORE, INTERCHANGEABLE
Eclipse Counterbore Co., Ltd., Walkerville, Ont.

DRILLS, CARBON
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Marshall, Son & Bunney, Toronto.
John Morrow Screw & Nut Co., Ingersoll.

DRILLS, ELECTRIC, PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener.
Cincinnati Electrical Tool Co., Cincinnati.
Geo. F. Foss Mch. & S'ply Co., Montreal.
Haskins Co., R. C., Chicago, Ill.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Pilot Steel & Tool Co., Montreal, Que.
Prest-O-Lite Co., Inc., Toronto, Ont.
U. S. Electrical Tool Co., Cincinnati, O.
A. R. Williams Mach. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLS, HAMMER
Samuel Osborne, Ltd., Montreal, P.Q.

DRILLS, EMERY
Garlock-Walker Mach. Co., Toronto, Ont.

DRILLS, HIGH SPEED TWIST
Aikenhead Hardware Co., Toronto, Ont.
Armstrong-Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Canadian Fairbanks-Morse Co., Montreal.
H. A. Drury Co., Montreal.
Geo. F. Foss Mch. & S'ply Co. Montreal
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
W. F. & John Barnes Co., Rockford, Ill.
Osborne, Samuel, Montreal, P.Q.
Pratt & Whitney Co., Dundas, Ont.
Petrie, H. W. Toronto.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Taylor J. A. M., Stair Bldg., Toronto.
Wilt Twist Drill Co. of Can., Walkerville.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLS, OIL TUBE
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

DRILLS, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Williams Mchy Co., Ltd., A. R., Montreal.
Greenfield Tap & Die Corp., Greenfield, Mass.

DRILLS, PNEUMATIC CORNER
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.

DRILLS, RATCHET AND HAND
Aikenhead Hardware Co., Toronto, Ont.
Armstrong Bros. Tool Co., Chicago, Ill.
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cincinnati Electrical Tool Co., Cincinnati.
Cleveland Twist Drill Co., Cleveland.
Garlock-Walker Mchy. Co., Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilt Twist Drill Co. of Can., Walkerville.

DRILLS, ROCK
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
The Foss Mchy. & Supply Co., Montreal.
Samuel Osborne Ltd., Montreal, P.Q.
A. R. Williams Machy. Co., Toronto

DRILLS, SQUARE & HEXAGON
Globe Engineering Co.

DRILLS, TRACK
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
The Foss Mchy. & Supply Co., Montreal.
Morrow Screw & Nut Co., J., Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Wilt Twist Drill Co. of Can., Walkerville.

DRINKING FOUNTAINS, SANITARY
Crane, Ltd., Montreal, Que.
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

DRIVES, CHAIN
See Belting, Chain.

DRIVING TOOLS
The Thos. Pink Co., Ltd., Pembroke, Ont.

DRY CLEANING SYSTEM
Bowser Co., Ltd., S. F., Toronto, Ont.

DRYERS, SAND
Lyman Tube & Supply Co., Montreal, Que.
Pangborn Corporation, Hagerstown, Md.

DRYING APPLIANCES
Baird Machine Co., Bridgeport, Conn.
Sturtevant Co., B. F., Galt, Ont.
W. S. Rockwell Co., New York, N.Y.

DRUM CONTROLS
Volta Manufacturing Co., Welland, Ont.

DUMP CARS
Canadian Fairbanks-Morse Co., Montreal.
MacKinnon Steel Co., Sherbrooke, Que.

DUST EXHAUSTER, ARRESTER SYSTEM
Pangborn Corporation, Hagerstown, Md.

DUST HANDLING EQUIPMENT
Pangborn Corporation, Hagerstown, Md.
Sturtevant Co., B. F., Galt, Ont.

DUST SEPARATORS
Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.

DYNAMOS AND ELECTRICAL SUPPLIES
Canadian Fairbanks-Morse Co., Montreal.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
MacGovern & Co., Montreal, Que.
A. R. Williams Machy. Co., Toronto.

ELECTRICAL SUPPLIES
Can. General Electric Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Northern Electric Co., Ltd., Montreal Que

ELECTRIC FURNACES
Electric Furnace Construction Co., Philadelpia, Pa.
Hamilton & Hansell, Inc., New York City
Volta Manufacturing Co., Welland, Ont.

EECTRIC FURNACE REGULATORS, WINCHES, ROOF COOLERS AND ELECTRODE HOLDERS
Volta Manufacturing Co., Welland, Ont.

ELECTRICAL RESISTANCE MATERIALS, NICHROME, KROMORE, CHROMAX, CLIMAX, NICKEL SILVER, ADVANCE.
Can. Driver-Harris Co., Walkerville, Ont.

ELECTRIC HOISTS, STATIONARY AND MONO RAIL
Canadian Link-Belt Co., Ltd., Toronto,
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Volta Manufacturing Co., Welland, Ont.

ELECTRIC MOTORS
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
Sturtevant Co., B. F., Galt, Ont.
Volta Manufacturing Co., Welland, Ont.

ELECTRIC TRUCKS
Cowan Truck Co., Holyoke, Mass.
Goad Engineering Co., Toronto, Ont.

ELEVATOR, ENCLOSURES
Volta Mfg. Co., Welland, Ont.
Canada Wire & Iron Goods Co., Hamilton

ELEVATOR WEIGHTS
Katie Foundry, Galt, Ont.

ELEVATORS AND BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machy. Co., St. Louis.

ELEVATING AND CONVEYING MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Petrie, Ltd., H. W., Toronto.

EMBOSSING PRESSES
Dom. Steel Products Co., Ltd., Brantford.
Oliver Machinery Co., Grand Rapids, Mich

EMERY GRINDERS (PNEUMATIC)
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.

EMERY CLOTH
Atkins & Co., E. C., Hamilton, Ont.

EMERY PAPER
Atkins & Co., E. C., Hamilton, Ont.

EMERY AND EMERY WHEELS
Atkins & Co., E. C. Hamilton, Ont.
Brantford Emery Wheel Co., Brantford, Canada.
The Foss Mchy. & Supply Co., Montreal.
Garvin Machine Co., New York.
Canadian Fairbanks-Morse Co., Montreal.
Canada Emery Wheels Co., Hamilton.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Wilkinson & Kompass, Hamilton, Ont.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.

EMERY WHEEL DRESSINGS
Dominion Abrasive Co., Ltd., Mimico, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

ENAMELWARE
Crane, Ltd., Montreal, Que.

END MILLS
John Morrow Screw & Nut Co., Ingersoll

ENGINEERS—INDUSTRIAL CLEANING (Free Consultation)
Oakley Chemical Co., New York, N.Y.

ENGINEERS
Samuel Osborne (Canada) Ltd., Montreal.

ENGINES—HOISTING, PILE DRIVING, BRIDGE ERECTING, MINING
Canadian Mead-Morrison Co., Limited, Montreal, Que.

ENGINES, STEAM, GAS, GASOLINE
Furniss, Clarke & Co., Montreal, Que.
Canadian Fairbanks-Morse Co., Montreal.
Johnson Mach. Co., Carlyle, Manchester, Conn.
MacGovern & Co., Montreal, Que.
Sturtevant Co., B. F., Galt, Ont.

ENGINES, HORIZONTAL AND VERTICAL
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Johnson Mach. Co., Carlyle, Manchester, Conn.
Petrie, Ltd., H. W., Toronto.
A. R. Williams Machy. Co., Toronto.

ENGINES, OIL
Ker & Goodwin Machine Co., Ltd., Brantford, Ont.

ENGINES, HEAVY OIL, DIESEL TYPE
Dom. Steel Products Co., Ltd., Brantford

ENGINES, MARINE
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Sturtevant Co., B. F., Galt, Ont.

ESCUTCHEON PINS
Parmenter & Bulloch, Gananoque, Ont.

EXHAUST HEADS AND HOODS
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Sturtevant Co., B. F., Galt, Ont.

EXHAUSTERS
Can. Blower & Forge Co., Kitchener, Ont.
Pangborn Corporation, Hagerstown, Md.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.

EXTRACTORS, TAP
Walton Co., The, Hartford, Conn.

EYE BOLTS AND NUTS
Can. Foundries & Forgings, Ltd., Welland, Ont.

EYE PROTECTORS
Standard Optical Co., Geneva, N.Y.

FACTORY GATES
Page Steel & Wire Co., Adrian, Mich.

FACTORY LOCATIONS
City of St. Johns, Quebec.

FACTORY SITES
City of St. Johns, Quebec.

FANS
Baird Machine Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.

FENCING, WIRE
Page Steel & Wire Co., New York, N.Y.

FENCE, IRON AND FACTORY
Can. Wire & Iron Goods, Hamilton, Ont.
Page Steel & Wire Co., Adrian, Mich.

FERRO-TUNGSTEN
Vanadium-Alloy Steel Co., Pittsburgh, Pa

FIBRE, RODS AND SHEETS
Diamond State Fibre Co., Bridgeport, Pa.

FILES
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Wm., Sheffield, Eng.
Ingersoll File Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont.
Marshall, Son & Bunney, Toronto, Ont.
Nicholson File Co., Port Hope, Ont.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
Whitman & Barnes Mfg. Co., Akron, O.
Wilkinson & Kompass, Hamilton, Ont.

FILES, COMMUTATOR SLOTTING
Lyman Tube & Supply Co., Montreal, Que.

FILING MACHINES, BENCH AND MOTOR DRIVEN
Barry Mfg. Co., Chicago, Ill.

FILTERING AND CIRCULATING SYSTEMS FOR LUBRICATING OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. Wire & Iron Goods, Hamilton, Ont.

FIRE BRICK
Elk Fire Brick Co., Hamilton, Ont.
General Combustion Co., Ltd., Montreal, Que.

FIRE CLAY
Elk Fire Brick Co., Can., Ltd., Hamilton
General Combustion Co., Ltd., Montreal, Que.

FINISHING MACHINES
Brown & Sharpe Mfg. Co., Providence, R.I.

FIRE EXTINGUISHERS
Strong, Kennard & Nutt Co., Cleveland, O.

FITTINGS, CAST IRON, SCREWED, FLANGED
Crane, Ltd., Montreal, Que.

FIXTURES
Brown Engineering Corp., Toronto, Ont.
Crescent Mche. Co., Ltd., Montreal, Que.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Toronto Tool Co., Toronto, Ont.

FLAT SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

FLEXIBLE SHAFT EQUIPMENT
R. C. Haskins Co., Chicago, Ill.

FLOODLIGHTS, ELECTRIC
...rn Electric Co., Ltd., Montreal Que

FLOTATION MACHINERY
Elec. Steel & Metals, Welland, Ont.

FLUMES
Can. Ingersoll-Rand Co., Ltd., Sherbrooke.
William Hamilton Co., Peterboro, Ont.

FORGES, HAND PORTABLE
... Hardware Co., Toronto, Ont.
... & Forge Co., Kitchener.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Sturtevant Co., B. F., Galt, Ont.

FORGE TOOLS
Kimber & Hillier Mfg., Co., St. Catharines, Ont.

FORGES, OIL
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.

FORGINGS
Mesta Machine Co., Pittsburgh, Pa
Can. Found. & Forgings, Ltd., Welland
Nova Scotia Steel & Coal Co., New Glasgow, N.S.

FORGINGS, DROP, AUTOMOBILE AND LOCOMOTIVE FORGING AND WELDING
Dominion Bridge Co., Montreal, Que.
Dom. Forge & Stamp'g Co., Walkerville
Steel Co. of Canada, Ltd., St. Catharines
Victoria Foundry Co., Ottawa.
Williams & Co., J. H., Brooklyn, N.Y.

FORGING MACHINERY
John Bertram & Sons Co., Dundas, Ont
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Toronto, Ont
National Machy. Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Chicago Flexible Shaft Co., Chicago, Ill

The City of ST. JOHNS Quebec

Merits your careful investigation as a location for your new factory

Located on the Richelieu River, which is a link in the chain of canals from New York to the St. Lawrence, St. Johns enjoys the advantages of a direct water route to the Eastern seaboard of the United States and the Great Lakes.

Seven railroads, including Canada's two great transcontinental lines, run through the city and are inter-connected in the St. Johns yards by a terminal switching company at very low rates.

St. Johns is known as the cheapest labour market in Canada. Skilled and unskilled labour is plentiful and labour troubles are unknown. Cheap electric power is developed at Chambly, eleven miles north-east of the city and the excellent railway connections assure a satisfactory coal supply.

Already an industrial centre, St. Johns is rapidly expanding and now offers extraordinary inducements to encourage the establishment of new industries, such as fifteen years' exemption from taxes, period subject to extension; all public improvements required; a bonus of 5% on your pay-roll for five years. If you desire it, the city will advance this to you, to be applied to the purchase or erection of any building suitable to your purpose.

For more specific information write

The Secretary of the City Council

St. Johns, Quebec, Canada

If interested tear out this page and place with letters to be answered.

FORGINGS, SPECIAL
Armstrong-Whitworth of Can., Montreal.
Can. Found. & Forgings, Ltd., Welland.
Williams & Co., J. H., Brooklyn, N.Y.

FORMING
Brown & Sharpe Mfg. Co., Providence, R.I.

FRICTION LEATHERS
Graton & Knight Mfg. Co., Montreal.

FRICTION SURFACE BELTING
Can. Consolidated Rubber Co., Montreal.

FUEL OIL SYSTEMS
Bowser Co., Ltd., S. F., Toronto, Ont.

FURNACES, ANNEALING, CASE HARDENING AND TEMPERING
Bellevue Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I.
Chicago Flexible Shaft Co., Chicago, Ill.
Gen. Combustion Co. Can., Ltd., Montreal.
Mechanical Eng'r'g Co., Three Rivers, Q.
W. S. Rockwell Co., New York, N.Y.
Petrie, Ltd., H. W., Toronto.

FURNACES, BLAST
Bellevue Industrial Furnace Co., Detroit.
Chicago Flexible Shaft Co., Chicago, Ill.
W. S. Rockwell Co., New York, N.Y.
Toronto Iron Works, Ltd., Toronto.

FURNACES — BRASS MELTING
General Combustion Co., Ltd., Montreal.

FURNACES — CRUCIBLE
Chicago Flexible Shaft Co., Chicago, Ill.

FURNACES, ELECTRIC
Electric Furnace Construction Co., Philadelphia, Pa.
Hamilton & Hansell, Inc., New York City.

FURNACES, FORGING
Chicago Flexible Shaft Co., Chicago, Ill.
Gen. Combustion Co. of Can., Ltd., Montreal.
W. S. Rockwell Co., New York, N.Y.

FURNACES — HIGH-SPEED STEEL
Chicago Flexible Shaft Co., Chicago, Ill.

FUSE BOXES, STEEL
Dom. Forge & Stamp. Co., Walkerville.

FUSE PLUGS AND FUSES
Northern Electric Co., Ltd., Montreal Que.

GALVANIZING FLUX
British Smelting & Refining Co., Ltd. Montreal, Que.

GANG PLANER TOOLS
Armstrong Bros. Tool Co., Chicago.

GAS AND STEAM ENGINES
Mesta Machine Co., Pittsburgh, Pa.

GASKETS, LEATHER, ETC.
Graton & Knight Mfg. Co., Montreal.

GASOLINE METERS
Bowser Co., Ltd., S. F., Toronto, Ont.

GASOLINE TANKS
Bowser Co., Ltd., S. F., Toronto, Ont.

GASOLINE PUMPS, SELF-MEASURING
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.

GAUGES
Crescent Mach. Co., Ltd., Montreal, P.Q.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.

GAUGERS, CALIPERS
Williams & Co., J. H., Brooklyn, N.Y.

GAUGES, MERCURY COLUMN, DRAFT
Taylor Instrument Co., Rochester, N.Y.

GAUGES, HYDRAULIC
Taylor Instrument Co., Rochester, N.Y.

GAUGES, MANUFACTURERS, LIMIT, THREAD
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Can., Galt, Ont.

GAUGES, SNAP, THREAD AND CYLINDRICAL
C. E. Johanson, Inc., Toronto, Ont.

GAUGES, VACUUM AND PRESSURE
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Rochester, N.Y.

GAUGES, STANDARD
Brown Engineering Corp., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Crescent Mchs. Co., Ltd., Montreal, Que.
Garvin Machine Co., New York.
C. E. Johanson, Inc., Toronto, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Hartford, Conn.
Taylor, J. A. M., 318 Stair Bldg., Toronto.
Toronto Tool Works, Toronto, Ont.
Wells Brothers Co. of Canada, Galt, Ont.

GEAR BLANKS
Can. Steel Foundries, Ltd., Montreal.
Can. Found. & Steel, Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Williams & Co., J. H., Brooklyn, N.Y.

GEAR BLANKS, CAST
Katie Foundry, Galt, Ont.

GEAR BLANKS, RAWHIDE
Lyman Tube & Supply Co., Montreal, Que.

GEAR BOXES, REDUCTION
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEAR SHAPERS AND CUTTERS
Fellows Gear & Shaper Co., Springfield, V.

GEAR-CUTTING MACHINERY
Bilton Mach. Tool Co., Bridgeport, Conn.
Fellows Gear & Shaper Co., Springfield, V.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
A. R. Williams Machy. Co., Toronto.

GEAR-TESTING MACHINE
Gisholt Machine Co., Madison, Wis.

GEARS, CHAIN
Morse Chain Co., Ithaca, New York.
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, COMPENSATING
Morse Chain Co., Ithaca, New York.
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, CUT, MORTISE, ANGLE, WORM
Can. Link-Belt Co., Toronto, Ont.
Diamond State Fibre Co., Bridgeport, Pa.
Dom. Steel Products Co., Ltd., Brantford.
Dominion Bridge Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Elliott & Whitehall, Galt, Ont.
Gardner, Robt., & Son, Montreal.
Hamilton Gear & Machine Co., Toronto.
Hull Iron & Steel Found., Ltd., Hull, Q.
Jones & Glassco, Montreal.
Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia.
Victoria Foundry Co., Ottawa.

GEARS, RAWHIDE
Gardner, Robt., & Son, Montreal.
Grant Gear Works, Boston, Mass.
Hamilton Gear & Machine Co., Toronto.
Hamilton Co., Ltd., Wm., Peterborough.
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia.
A. R. Williams Machy. Co., Toronto.

GENERATORS, GEAR
Fellows Gear & Shaper Co., Springfield, V.

GEARS, SILENT CHAIN
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, SPRING
Morse Chain Co., Ithaca, New York.

GEARS, SPUN, BENCH, SPIRAL
Brown & Sharpe Mfg. Co., Providence, R.I.

GENERAL MACHINE WORK
Elliott & Whitehall, Galt, Ont.

GENERATORS AND CONVERTORS
Northern Elec. Co., Ltd., Montreal, P.Q.

GENERATORS, MOTOR
MacGovern & Co., Montreal.
Northern Elec. Co., Ltd., Montreal, P.Q.
Sturtevant Co., B. F., Galt, Ont.

GENERATORS, STEAM TURBO
Can. Link-Belt Co., Ltd., Toronto, Ont.

GILDING
Brown's Copper and Brass Rolling Mills New Toronto.

GLOVES, ASBESTOS, ACID PROOF, WATERPROOF, ETC.
Streng, Kennard & Nutt Co., Cleveland.

GLUE HEATERS
Olivar Machinery Co., Grand Rapids, Mich.

GLASSES, SAFETY
Strong, Kennard & Nutt Co., Cleveland.
Willson & Co., Inc., T. A., Reading, Pa.

GRAPHITE
Aikenhead Hardware, Ltd., Toronto.
Rice Lewis & Son, Toronto.

GOGGLES
Consolidated Optical Co., Toronto.
Standard Optical Co., Geneva, N.Y.

GRAB BUCKETS—CLAMSHELL and ORANGE PEEL
Canadian Link-Belt Co., Ltd., Toronto, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Que.

GRAVITY CARRIERS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.
Morris Crane & Hoist Co., Ltd., Herbert Niagara Falls, Ont.

GREASE CUPS, PRESSED STEEL, BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES (See Lubricants)

GRINDERS, AUTOMATIC KNIFE
Canada Machinery Corp., Galt, Ont.
Foss Mchry. & S'ply Co., G. F., Montreal
Garlock-Walker Machinery Co., Toronto.

GRINDERS, BENCH
Superior Machinery Co., London, Ont.

GRINDERS, CENTRE COLUMN, PEDESTAL AND BENCH
Can. Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Haskins & Co., R. C., Chicago, Ill.
Wisconsin Electric Co., Inc., Racine, Wis.
Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto.
Katie Foundry, Galt, Ont.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford.
Niles-Bement-Pond Co., New York, N.Y.
Perfect Machine Co., Galt, Ont.
United States Elec. Tool Co., Cincinnati.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, CUTTER
Brown & Sharpe Mfg. Co., Providence, R.I.
Cincinnati Milling Mach. Co., Cincinnati.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Globe Engineering Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield, M.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Norton Co., Worcester, Mass.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, DIE AND CHASER
Haskins & Co., R. C., Chicago, Ill.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
National-Acme Co., Cleveland, Ohio.

GRINDERS, DISK
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., E. C., Hamilton, Ont.
Ford-Smith Mach. Co., Hamilton.
Gardner Machine Co., Beloit, Wis.
Heald Machine Co., Worcester, Mass.

GRINDERS, FLEXIBLE CASTING
Manhattan Machine & Tool Co., Grand Rapids, Mich.

GRINDERS, DRILL
Aikenhead Hardware Co., Toronto.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield.
Petrie, Ltd., H. W., Toronto.
United States Elec. Tool Co., Cincinnati.
Wells Bros. of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, CYLINDER, INTERNAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Foss Mchy. & S'ply Co., G. F., Montreal.
Greenfield Machine Co., Greenfield, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, PORTABLE, ELECTRIC HAND, TOOL POST, FLOOR AND BENCH
Baird Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Ford-Smith Mach. Co., Hamilton, Ont.
Haskins & Co., R. C., Chicago, Ill.
Grant Mfg. & Mach. Co., Bridgeport, Con.
Garlock-Walker Machinery Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Independent Pneumatic Tool Co., Chicago.
Petrie, Ltd., H. W., Toronto.
United States Elec. Tool Co., Cincinnati.
Wisconsin Electric Co., Inc., Racine, Wis.
Williams Mchy Co., A. R., Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.

GRINDERS, MANUFACTURING
Barber Mchy. Co., Ltd., Toronto, Ont.
Universal Grinding Mach. Co., Fitchburg, Mass.

GRINDERS, HOLE, HOLE AND AND DEEP HOLE
Barber Mchy. Co., Ltd., Toronto, Ont.
Bryant Chucking Grinder Co., Springfield, Vermont.
Heald Machine Co., Worcester, Mass.

GRINDERS, PLAIN CYLINDRICAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Fitchburg Grinding Mach. Co., Fitchburg, Mass.

GRINDERS, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal.
Cleveland Pneumatic Tool Co., Toronto.
Garlock-Walker Machinery Co., Toronto.
Heald Machine Co., Worcester, Mass.
Independent Pneumatic Tool Co., Chicago
MacGovern & Co., Montreal, Que.

GRINDERS, PROFILE
Cleveland Milling Machine Co., Cleveland.

GRINDERS, ROTARY SURFACE
Brown & Sharpe Mfg. Co., Providence, R.I.
Bristol Machine Tool Co., Bristol, Conn.
Manhattan Machine & Tool Co., Grand Rapids, Mich.

GRINDERS, TOOL AND HOLDER
Armstrong Bros. Tool Co., Chicago.
W. F. & John Barnes Co., Rockford, Ill.
Blount & Co., J. G., Everet, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield.
National-Acme Co., Cleveland, Ohio.
Tabor Mfg. Co., Philadelphia, Pa.
Wells Bros. of Canada, Galt, Ont.

GRINDERS, UNIVERSAL, PLAIN
Barber Mchy. Co., Ltd., Toronto, Ont.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Modern Tool Co., Erie, Pa.
Norton Co., Worcester, Mass.
Williams Mchy Co. Ltd., A. R., Montreal

GRINDERS, VERTICAL, SURFACE
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Montreal.
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Norton Co., Worcester, Mass.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDING DISCS
Wausau Abrasives Co., Chicago, Ill.

GRINDING AND POLISHING MACHINES, PORTABLE, PNEUMATIC AND SPRING FRAME
Can. Fairbanks-Morse Co., Montreal.
Cincinnati Elec. Tool Co., Cincinnati, O.
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal.
Garvin Machine Co., New York.
Garlock-Walker Machy. Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Haskins & Co., R. C., Chicago, Ill.
Hall & Sons, John H., Brantford, Ont.
Niles-Bement-Pond Co., New York, N.Y.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Wisconsin Electric Co., Racine, Wis.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDING MACHINES, CAR WHEEL, CUTTER, CYLINDRICAL, CRANKSHAFT
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Norton Co., Worcester, Mass.

GRINDING WHEELS
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Brantford Emery Wheel Co., Brantford.
Can. Fairbanks-Morse Co., Montreal.
Carborundum Co., Niagara Falls, N.Y.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Mchy. & S'ply Co. G. F., Montreal.
Norton Co., Worcester, Mass.

GRINDING WHEEL DRESSER
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.

GUARDS, WINDOW AND MACHINE
Canada Machinery Corp., Galt, Ont.
Canada Wire & Iron Goods Co., Hamilton
Dennis Wire & Iron Works, London, Ont.
B. Greening Wire Co., Hamilton, Ont.
Page Steel & Wire Co., Adrian, Mich.

GUTTERS AND SKYLIGHTS
H. H. Robertson, Ltd., Sarnia, Ont.

HACK SAW BLADES
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Wks., Buffalo.
Ford-Smith Machine Co., Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Plewes, Ltd., Winnipeg, Man.
Pilot Steel & Tool Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Racine Tool & Machine Co., Racine, Wis.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
L. S. Starrett Co., Athol, Mass.
Standard Machy. & Supplies, Montreal.
Victor Saw Works, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.
Williams Mchy Co., A. R., Toronto, Ont.

HANDLES, BALANCE, CRANK AND MACHINE
Williams & Co., J. H., Brooklyn, N.Y.

HANGERS, SHAFT
Can. Link-Belt Co., Ltd., Toronto, Ont.

HACK SAW FRAMES
Aikenhead Hardware Co., Toronto.
Atkins & Co., E. C., Hamilton, Ont.
Can. Fairbanks-Morse Co., Montreal.
Ford-Smith Machine Co., Hamilton, Ont.
Garvin Machine Co., New York City.
Victor Saw Works, Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.

HACK SAWS, POWER
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Wks., Buffalo.
Foss Mchy. & S'ply Co., G. F., Montreal.
Ford-Smith Machine Co., Hamilton.
Perfect Machine Co., Galt, Ont.
Starrett Co., L. S., Athol, Mass.
Victor Saw Works, Hamilton, Ont.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

HAMMERS, FORGING
Nazel Eng. & Mach. Wks., Philadelphia.

HAMMERS, ELECTRIC
Haskins & Co., R. C., Chicago, Ill.

1st Careful laboratory work watches the fitness of the steel itself.

2d The micrometer faithfully guards the uniform correctness of jigs, dies and tools.

3d This test picture shows how the accuracy of bushings is guarded.

4th Guarding circumference accuracy. Lasting trueness is assured by a series of such tests.

5th Perfect balance is insisted upon and guarded with the utmost care. Interchangeable parts help make this possible.

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THE illustrated tests are only a few of a long series of continuous safeguards of accuracy. These successive tests—based on the concentrated study of the pulley, its parts and its purpose—are the strongest possible assurance of uniform perfection. Variance is precluded. Each "American" Pulley is as true and perfect as every other "American."

And there is put into each separate part the same degree of perfection in design and construction as is finally found in the completed pulley. This guarding of accuracy at every stage of production should appeal to the most uncompromising engineer.

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The American Pulley Co.
Philadelphia, Pa.

More than Five Million "American" Pulleys now save power in efficient plants here and abroad. The steel split pulley combines strength and durability with lightness, and it is quickly installed without stripping of busy shafts.

The AMERICAN PULLEY

"A wheel with a broad rim transmitting power from or imparting power to machinery, or changing the direction of motion by means of a flat belt."

If interested tear out this page and place with letters to be answered.

HAMMERS (DROP), MOTOR AND BELT DRIVEN

Beaudry & Co., Boston, Mass.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton.
Can. Billings & Spencer, Ltd., Welland.
Canada Machinery Corp., Galt, Ont.
High Speed Hammer Co., Rochester, N.Y.
Jardine & Co., A. B., Hespeler, Ont.
Niles-Bement-Pond Co., New York, N.Y.
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
United Hammer Co., Boston, Mass.
Williams Mchy Co, Ltd., A. R., Montreal

HAMMERS, HELVE POWER

Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
West Tire Setter Co., Rochester, N.Y.
Williams Mchy Co, Ltd., A. R., Montreal

HAMMERS, CHIPPING, CAULKING, PNEUMATIC

Can. Ingersoll-Rand Co., Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Nazel Eng. & Mach. Wks., Philadelphia.

HAMMERS, MARKING

Matthews & Co., Jas. H., Pittsburgh, Pa.

HAMMERS, NAIL MACHINE

Rice Lewis & Son, Toronto, Ont.
United Hammer Co., Boston, Mass.

HAMMERS, POWER

Nazel Eng. & Mach. Wks., Philadelphia

HAMMERS, STEAM

Canada Machinery Corp., Galt, Ont.
Niles-Bement-Pond Co., New York.

HAND PLANERS

Oliver Mchry. Co., Grand Rapids, Mich.

HAND PLANING AND JOINTING MACHINERY

Oliver Engineering Co., Montreal, P.Q.

HAND LEATHERS OR PADS

Graton & Knight Mfg. Co., Montreal

HANDLES, FIBRE

Diamond State Fibre Co., Bridgeport, Pa.

HANGERS

Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian Link-Belt Co., Ltd., Toronto, Ont.

HANGERS, SHAFT

Algoma Steel Corp., Sault Ste. Marie.
Chapman Double Ball Bearing Co., Toronto.
Gray Ball Bearing Co., Ltd., Toronto.
Baird Machine Co., Bridgeport, Conn.
Can. S K F Co., Toronto, Ont.
Gardner & Son, Robt., Montreal.
Jones & Glassco, Montreal.
Williams Mchy Co, Ltd., A. R., Montreal

HARDNESS TESTING INSTRUMENTS

Shore Instrument & Mfg. Co., New York.

HEAD, AUXILIARY

Hoefer Mfg. Co., Freeport, Ill.

HEATING AND VENTILATING ENGINEERS

Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.

HEAT GAUGES, HARDENING AND ANNEALING

Shore Instrument & Mfg. Co., New York

HELMETS, SANDBLAST, AMMONIA

Strong, Kennard & Nutt Co., Cleveland

HIGH SPEED STEEL

See Steel.

HINGE MACHINERY

Baird Machine Co., Bridgeport, Conn.

HINGES

Butterfield & Co., Inc., Rock Island, Que.
London Bolt & Hinge Wks., London, Ont.

HOBS

Greenfield Tap & Die Co., Greenfield, Mass.
Pratt & Whitney Co., Dundas, Ont.
Taylor, J. A. M., 318 Stair Bldg., Toronto
Wells Bros. of Canada, Galt, Ont.

HOISTING MACHINERY

Canadian Mead-Morrison Co., Limited, Montreal, Que.

HOISTS, AIR

Can. Ingersoll-Rand Co., Ltd., Sherbrooke
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

HOISTS, CHAIN AND PNEUMATIC

Can. Ingersoll-Rand Co., Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Ford Chain Block & Mfg., Philadelphia.
Independent Pneumatic Tool Co., Chicago
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

HOISTS, ELEC., STATIONARY, MONO RAIL

Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
A. Beatty & Sons, Ltd., Welland, Can.
Oliver Engineering Co., Montreal.
Volta Mfg. Co., Welland, Ont.

HOISTS, ELECTRICAL

Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Montreal, Que.
Electric Steels & Metals Ltd., Welland
Kennedy & Sons, Owen Sound, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

HOLDERS, ADJUSTABLE LENGTH

Eclipse Counterbore Co., Ltd., Walkerville, Ont.

HOLDERS, STEEL DIE FOR MARKING

Matthews & Co., Jas. H., Pittsburgh, Pa.

HOLDERS, ELECTRIC

Electric Steels & Metals, Ltd., Welland

HOOKS, BELT LACING

Clipper Belt Lacer Co., Grand Rapids.

HOPPERS

MacKinnon Steel Co., Ltd., Sherbrooke.
Dominion Bridge Co., Montreal, Que.
William Hamilton Co., Peterboro, Ont.
Toronto Iron Works, Ltd., Toronto, Ont.

HOSE, FIRE PROTECTION

Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal

HOSE, PNEUMATIC

Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Gutta Percha & Rubber, Ltd., Toronto.
Independent Pneumatic Tool Co., Chicago.
Quaker City Rubber Co., Philadelphia, Pa.
Wells Bros. Co. of Canada, Galt, Ont.

HOSE, ALL KINDS

Goodyear Tire & Rubber Co., of Canada, Ltd., Toronto.
Gutta Percha & Rubber, Ltd., Toronto.
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.

HOSE, SAND BLAST

Pangborn Corporation, Hagerstown, Md.
Goodyear Tire & Rubber Co. of Can., Ltd. Toronto
Quaker City Rubber Co., Philadelphia, Pa.
Intern'l. Machine Tool Co., Indianapolis.

HOSE, STEAM, SUCTION AND WATER

Gutta Percha & Rubber, Ltd., Toronto.
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.

HUMIDIFIERS

Sturtevant Co., B. F., Galt, Ont.

HYDRAULIC ACCUMULATORS

Dom. Steel Products Co., Ltd., Brantford.

HYDRAULIC MACHINERY

Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
West Tire Setter Co., Rochester, N.Y.
Victoria Foundry Co., Ottawa.

HYDRAULIC TURBINES

Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.

HYDROMETERS, HYGROMETERS, HYGRODEIKS

Taylor Instrument Co., Rochester, N.Y.

INDICATORS, SPEED

Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol, Mass.

INDEX CENTRES

Brown & Sharpe Mfg. Co., Providence, R.I.
Dickow, Fred. O., Chicago, Ill.
Ford-Smith Machine Co., Hamilton, Ont.
Garvin Machine Co., New York.
Petrie, Ltd., H. W., Toronto.

INDICATING INSTRUMENTS

Taylor Instrument Co., Rochester, N.Y.

INDICATING SCALES

Can. Kron Scale Co., Montreal.

INDUSTRIAL SITES

City of St. Johns, Quebec.

INGOTS, BRASS, BRONZE, GUN METAL, PHOSPHOR

Thomas Moore & Son, Montreal.

INGOTS, FORGING AND ROLLING

Electric Steel & Metals Co., Welland.

INSULATING COMPOUNDS

Robertson Co., Ltd., H. H., Sarnia, Ont.

INSTRUMENTS, ENGINEERING

Consolidated Optical Co., Toronto.

IRON ORE

Hanna & Co., M. A., Cleveland, O.

IRON, WROUGHT, ROLLED, PIG

Swedish Steel & Impt. Co., Ltd., Montreal

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Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
The Engineering Co.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Norton, A. O., Coaticook, Que.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.

JACKS, PIT AND TRACK

Canadian Fairbanks-Morse Co., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Northern Crane Works, Walkerville.

JAWS, FACE PLATE

Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford.
Skinner Chuck Co., New Britain, Conn.

JIGS, TOOLS, ETC.

Brown Engineering Corp., Toronto.
Crescent Mach. Co., Ltd., Montreal, P.Q.
Elliott & Whitehall Mach. & Tool Co., Galt.
Gisholt Machine Co., Madison, Wis.
Globe Engineering Co., Ltd., Hamilton.
Homer & Wilson, Hamilton, Ont.
Jones & Lamson, Springfield, Vt.
Toronto Tool Co., Toronto, Ont.

JOURNAL WEDGES

Canada Foundries & Forgings, Welland.
Dominion Foundries & Steel Ltd., Hamilton, Ont.

KEY SEATERS

Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Morton Mfg. Co., Muskegon Heights, M.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.

KEYS, MACHINE

Whitney Mfg. Co., Hartford, Conn.
Williams & Co., J. H., Brooklyn, N.Y.

KILNS

Can. Blower & Forge Co., Kitchener, Ont.
General Combustion Co., Ltd., Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Sturtevant Co., B. F., Galt, Ont.

KNIVES, MACHINE

Atkins & Co., E. C., Hamilton, Ont.

LABELS AND TAGS

Matthews & Co., Jas. H., Pittsburgh, Pa.

LABORATORIES, INSPECTION AND TESTING (see Chemists)

LADLES, FOUNDRY

Northern Crane Works, Walkerville.

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LAG SCREW GIMLET POINTERS

National Machy. Co., Tiffin, Ohio.

LATH

Robertson, Ltd., H. H., Sarnia, Ont.

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Petrie, Ltd., H. W., Toronto.
Wood Turret Machine Co., Brazil, Ind.

LATHE CHUCKS (See Chucks)

LATHE DOGS AND ATTACHMENTS

Armstrong Bros. Tool Co., Chicago.
Hendey Machine Co., Torrington, Conn.
Williams & Co., J. H., Brooklyn, N.Y.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC

Gisholt Machine Co., Madison, Wis.
Wood Turret Machine Co., Brazil, Ind.

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Betts Mach. Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.

LATHES, BORING

Barber Mchy. Co., Ltd., Toronto, Ont.
Bridgeford Mach. Tool Works, Rochester.
Canada Machinery Corp., Galt, Ont.
Lodge & Shipley, Cincinnati, O.
Petrie, Ltd., H. W., Toronto.

LATHES, PRECISION, BENCH

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J. G. Blount & Co., Everett, Mass.
Canadian Fairbanks-Morse Co., Montreal.
Geo. F. Foss Machy. & Supply Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Hardinge Bros., Chicago, Ill.
Pratt & Whitney Co., Dundas, Ont.
Seneca Falls Mfg Co., Seneca Falls, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

LATHES, BRASS

Acme Machine Tool Co., Cincinnati, Ohio.
Hardinge Bros., Chicago, Ill.
Wood Turret Machine Co., Brazil, Ind.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Acme Machine Tool Co., Cincinnati, O.
Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons, Co., Dundas.
Canada Machy. Corp., Galt, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cisco Machine Tool Co., Cincinnati, O.
G. F. Foss, Mchy. & S'ply Co., Montreal
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
Kennedy & Sons, Wm., Owen Sound, Ont.
Lehman Mach. Co., St. Louis, Mo.
R. McDougall Co., Galt.
Niles-Bement-Pond Co., New York.
Perfect Machine Co., Galt, Ont.
Rae Mach. Tool Co., Hamilton.
Smalley-General Co., Inc., Bay City, Mich.
Standard Equipment & Tool Wks. Montreal, P.Q.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Sidney Tool Co., Sidney, Ohio.
Walcott Lathe Co., Jackson, Mich.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.

A. R. Williams Machy. Co., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

LATHES, FOOT POWER

Seneca Falls Mfg. Co., Seneca Falls, N.Y.

LATHES, HORIZONTAL

Intern'l. Mchy. Supplies Ltd., Montreal.
Wood Turret Machine Co., Brazil, Ind.

LATHES, JOURNAL TRUEING

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Canada Machinery Corp., Galt, Ont.

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Elliott & Whitehall, Galt, Ont.

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Wood Turret Machine Co., Brazil, Ind.
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Garlock-Walker Machy. Co., Toronto, Ont.

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Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

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Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas, Ont.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Cisco Machine Tool Co., Cincinnati, O.
Foss Mchy. & Sply Co., G. F., Montreal
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Toronto, Ont.
Hardinge Bros., Inc., Chicago, Ill.
Hepburn Ltd., John T., Toronto, Ont.
Lehman Machine Co., St. Louis, Mo.
Niles-Bement-Pond Co, New York.
Rae Mach. Tool Co., Hamilton.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.
Williams Machy. Co., A. R., Toronto.
Wood Turret Machine Co., Brazil, Ind.

LATHES, SPINNING

Bliss Co., E. W., Brooklyn, N.Y.

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Barber Mchy. Co., Ltd., Toronto, Ont.
Cisco Machine & Tool Co., Cincinnati, O.
Canada Machinery Corporation, Galt, Ont.
Knight Metal Products, Toronto.
Lehman Machine Co., St. Louis, Mo.
Rae Mach. Tool Co., Hamilton.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.

LATHES, QUICK CHANGE

Lehman Machine Co., St. Louis, Mo.

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Atkins & Co., E. C., Hamilton, Ont.

LATHES, TURRET

Hardinge Bros., Chicago, Ill.
Acme Machine Tool Co., Cincinnati, Ohio

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British Smelting & Refining Co., Ltd., Montreal, Que.

LEAD BURNING OUTFITS

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LEATHER STRAPPING

Graton & Knight Mfg. Co., Worcester, M.

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LEVELS

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Can. Winkley Co., Ltd., Windsor, Ont.

LINK BELTING

See Belting, Chain.

LIFT TRUCKS

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LINOLEUM MILL MACHINERY

Bertrams, Ltd., Edinburgh, Scotland.

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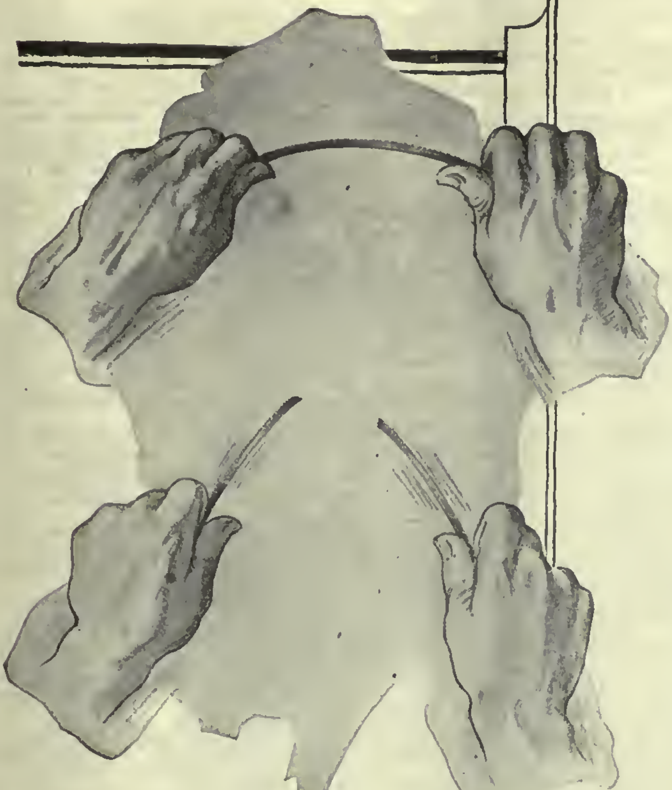
Katie Foundry, Galt, Ont.

MACHINE TOOLS

Barber Mach. Co., F. F., Toronto, Ont.
Knight Metal Products, Toronto.
Rae Mach. Tool Co., Hamilton.



broken blades are not always poor blades.

Often it's a case of a good saw used in the wrong way. A hack saw may be brittle as glass or flexible as a watch spring, according to the temper of steel, but the temper is only one of the things that go to make good blades.

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Starrett Hack Saws plus the Starrett Hack Saw Chart make it easier to cut metal economically. Ask for a copy of Chart "3"-and "Hack Saws and Their Use"—both are free.

THE
L. S. STARRETT COMPANY
The World's Greatest Toolmakers
Mfrs. of Hack Saws Unexcelled
ATHOL, MASS.

42-64

Starrett Hack Saws

If interested tear out this page and place with letters to be answered.

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Can. Fairbanks-Morse Co., Montreal.
Elliott & Whitehall, Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Williams Machy. Co., A. R., Toronto.

MACHINERY GUARDS (See Guards)

MACHINERY SUPPLIES
Crescent Machine Co., Ltd., Montreal.
Globe Engineering Wks., Hamilton, Ont.
Knight Metal Prodncts, Toronto.

MACHINERY, SPECIAL
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Crescent Mechine Co., Ltd., Montreal, Qne.
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Brown & Sharpe Mfg. Co., Providence, R.I.

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Volta Mfg. Co., Welland, Ont.

MANDRELS
Butterfield & Co., Inc., Rock Island, Que.
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Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Pratt & Whitney Co., Dundas, Ont.

MARKING DEVICES
Matthews & Co., Jas. H., Pittsburgh, Pa

MARKING MACHINERY
Brown, Boggs Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal
Perrin, Wm. R., Toronto.
Petrie, Ltd., H. W., Toronto.

MATERIALS, HANDLING PLANTS
Canadian Mead-Morrison Co., Limited, Montreal, Que.

MATS, RUBBER MATTING
Quaker City Rubber Co., Philadelphia, Pa
International Mchy. Sply., Ltd., Montreal

MEASURING MACHINES
Pratt & Whitney Co., Dundas, Ont.

MEASURES, REGISTERING
Bowser Co., Ltd., S. F., Toronto, Ont.

MEASURING TAPES AND RULES
Chesterman & Co., Jas., Sheffield, Eng.

MERCHANTS, IRON AND STEEL
Samuel Osborne (Can.), Ltd., Montreal.

METALLURGISTS
See Chemists.

METAL CLEANERS
Oakley Chemical Co., New York, N.Y.

METAL CUTTING MACHINES
Atkins & Co., E. C., Hamilton, Ont.
Lyman Tube & Supply Co., Montreal, Que.

METAL SAWS
See Saws.

METAL, ANTI-FRICTION
Thos. Moore & Son, Montreal.

METAL SAWS, POWER
E. C. Atkins & Co., Inc., Indianopils.
Hoefer Mfg. Co., Freeport, Ill.
Lyman Tube & Supply Co., Montreal, Que.

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British Smelting & Refining Co., Ltd., Montreal, Que.
Brown's Copper & Brass Rolling Mills, New Toronto, Ont.
Canada Metal Co., Toronto, Ont.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.

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Bowser Co., Ltd., S. F., Toronto, Ont.
General Combustion Co., Ltd., Montreal, Que.

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Taylor, J. A. M., 318 Stair Bldg., Toronto.
Petrie, Ltd., H. W., Toronto.

MILLS, BRACE AND TUBE
Elec. Steel & Metals, Welland, Ont.

MILL SPECIALTIES
Atkins & Co., E. C., Hamilton, Ont.

MILLS, SAND
Frost Mfg. Co., Chicago, Ill.

MILL MACHINERY
Alexander Fleck, Ltd., Ottawa.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

MILLING ARBORS
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.

MILLING ATTACHMENTS
Barber Mchy. Co., Ltd., Toronto, Ont.
Becker Milling Machine Co., Boston, Mass.
Bertram & Sons Co., John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence.
Canada Machinery Corp., Galt, Ont.
Cincinnati Milling Machine Co., Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal
Hardinge Bros., Inc., Chicago, Ill.
Hendey Mach. Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Taft-Peirce Mfg. Co., Woonsocket, R.I.

MILLING MACHINES, AUTOMATIC
Bilton Mach. Tool Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Setts Machine Co., Rochester, N.Y.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.

MILLING CUTTERS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Milling Machine Co., Cleveland.
Delore Smelting & Refining Co., Ltd, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Marshall, Son & Bunney, Toronto.
Petrie, Ltd., H. W., Toronto.
Wilt Twist Drill Co., Walkerville, Ont.

MILLING MACHINES, HAND
Bristol Machine Tool Co., Bristol, Conn.

MILLING MACHINES, THREAD
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Inc., Chicago, Ill.
Gray Ball Bearing Co., Ltd., Toronto.
United States Mach. Tool Co., Cincinnati.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Smalley Gen. Co., Inc., Bay City, U.S.A.
Standard Equipment & Tool Wks., Montreal, P.Q.

MILLING MACHINES, HORIZONTAL AND VERTICAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Becker Milling Machine Co., Boston, Mass
Bristol Machine Tool Co., Bristol, Conn.
Brown & Sharpe Mfg. Co., Providence.
Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Knight Metal Products, Toronto.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
[illegible] Ltd., H. W., Toronto.
Rockford Milling Mach. Co., Rockford, Ill
United States Mach. Tool Co., Cincinnati.
Whitney Mfg. Co., Hartford, Conn.
Williams Machy. Co., A. R., Toronto.

MILLING MACHINES, PLAIN, BENCH AND UNIVERSAL
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Becker Milling Machine Co, Boston, Mass.
Bilton Mach. Tool Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence.
Canada Machinery Corp., Galt, Ont.
Cleveland Milling Machine Co., Cleveland.
Cincinnati Milling Machine Co., Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
National Machy. Co., Tiffin, Ohio.
Gooley & Edlund, Inc., Cortland, N.Y.
Hardinge Bros., Inc., Chicago, Ill.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Knight Metal Products, Toronto.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.

MILLING MACHINES, PROFILE
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
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Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Aikenhead Hardware Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
Ford-Smith Mach. Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

MINE CARS
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dominion Bridge Co., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.

MINING MACHINERY
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Elec. Steel & Metals, Welland, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

MIXERS, SAND
Frost Mfg. Co., Chicago, Ill.

MORTISING MACHINES
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
Gray Ball Bearing Co., Ltd., Toronto.

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Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
MacGovern & Co., Montreal, Que.
Northern Elec. Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
U. S. Ordnance, Toronto, Ont.
Volta Mfg. Co., Welland, Ont.
Williams Mach'y Co., A. R., Toronto.

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MOTORCYCLE FRAME AND FORK
The Dunbar Brothers Co., Bristol, Conn.

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Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto.

MOULDS, RUBBER
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

MULTIPLE INDEX CENTRES
Garvin Machine Co., New York.
Graton & Knight Mfg. Co., Worcester, M.

MULTI-DRILLING, MULTI-BORING, MULTI-TAPPING MACHINERY,
Nat. Automatic Tool Co., Richmond, Ind.

MUNICIPALITIES
City of St. John, Quebec.

NAIL SETS
Morrow Screw & Nut Co., J., Ingersoll, Ont

NAME PLATES, BRONZE, ETCHED AND STAMPED
Matthews & Co., Jas. H., Pittsburgh, Pa.
Turner Brass Works, Sycamore, Ill.

NICHROME CASTINGS
Can. Driver-Harris Co., Ltd., Walkerville.

NICKEL
Pilot Steel & Tool Co., Montreal, Que.

NICKEL STEEL
See Steel.

NICKEL SILVER—SHEETS, ROLLS, PLATES and RODS
Brown's Copper and Brass Rolling Mills, New Toronto.

NIPPLE THREADING MACHINES
Hall & Sons, Ltd., John H., Brantford.
Landis Machine Co., Waynesboro, Pa.

NITROGEN
Carter Welding Co., Toronto, Ont.

NUTS, STEEL, CASTELLATED AND COLD PRESSED
Galt Machine Screw Co., Ltd., Galt, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Williams & Co., J. H., Brooklyn, N.Y.

NUTS, SEMI-FINISH AND FINISHED
Galt Machine Screw Co., Galt, Ont.
National-Acme Co., Cleveland, Ohio.
Wilkinson & Kompass, Hamilton.

NUT LOCKS
Edw. W. Robinson Co., Ltd., Montreal.

NUT BURRING AND NUT MACHINES (HOT)
National Machy. Co., Tiffin, Ohio.

NUT FACING AND BOLT SHAVING MACHINES
Garvin Machine Co., New York.
National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Victor Tool Co., Waynesboro, Pa.

NUT TAPPERS
Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
Hall & Son, J. H., Brantford, Ont.
Jardine & Co., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.

OILERS
All-Way Oiler Mfg. Co., Toronto, Ont.

OIL SEPARATORS
Can. Fairbanks-Morse Co., Montreal.

OIL STONES
Aikenhead Hardware Co., Toronto, Ont.
Carborundum Co., Niagara Falls, N.Y.
Norton Co., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.

OIL STONE GRINDERS
Oliver Machy. Co., Grand Rapids, Mich.

OIL STORAGE SYSTEMS
Bowser Co., Ltd., S. F., Toronto, Ont.
St. Lawrence Welding Co., Ltd., Montreal.

OPENING DIE HEADS
Greenfield Tap & Die Corp, Greenfield.
Wells Bros. of Canada, Galt, Ont.

OPTICAL SUPPLIES
Consolidated Optical Co., Toronto, Ont.

ORE HANDLING EQUIPMENT
Brown Hoisting Machinery Co., Cleveland, Ohio.
Canadian Link-Belt Co., Ltd., Toronto, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Qne.

OSCILLATING VALVE GRINDERS (PNEUMATIC)
Cleveland Pneumatic Tool Co. of Canada, Toronto

OVENS FOR BAKING, BLUING, DRYING, ENAMELING, JAPANNING AND LACQUERING
Brantford Oven & Rack Co., Brantford.

OVEN TRUCKS, STEEL
Brantford Oven & Rack Co., Brantford.
MacKinnon Steel Co., Sherbrooke, Que.

OVENS FOR DRYING, TEMPER AND OXYGEN, ELECTROLYTIC CELLS UNDER TRUCKS
Welding & Supplies Co., Montreal, Que.
Brantford Oven & Rack Co., Brantford.

OXY-ACETYLENE WELDING AND CUTTING AND OUTFITS
Carter Welding Co., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.
Prest-o-Lite Co., Inc. Toronto, Ont.
Davis-Bournonville Co., Toronto, Ont.

OXYGEN
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto, Ont.
Nat. Electro Products Ltd., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.

OXYGEN PLANTS (ELECTROLYTIC)
Davis-Bournonville Co., Toronto, Ont.

PACKINGS, ASBESTOS
Cleveland Wire Spring Co., Cleveland.

PACKING, ROD AND SHEET
Dunlop Tire & Rubber Goods Co., Ltd. Toronto.
Goodyear Tire & Rubber Co., Can., Ltd. Toronto
Gutta Percha & Rubber, Ltd., Toronto.
International Mach. Spls., Ltd., Montreal
Petrie, Ltd., H. W., Toronto.
Quaker City Rubber Co., Philadelphia, Pa

PANS, WET AND DRY
Frost Mfg. Co., Chicago, Ill.

PAPER MILL CONVEYORS AND DRIVES
Bertrams, Ltd., Edinburgh, Scotland.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Gutta Percha & Rubber, Ltd., Toronto.
MacKinnon Steel Co., Sherbrooke, Que.

PARTITIONS, WIRE
See Guards

PAPER MILL MACHINERY
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Machinery Co., Toronto.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

PATTERN SHOP EQUIPMENT
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Oliver Machy. Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto.

PATTERN MAKERS' LATHES
See Lathes.

PATENT SOLICITORS
Budden, Hanbury A., Montreal.
Fetherstonhaugh & Co., Ottawa.
Marion & Marion, Montreal.
Ridout & Maybee, Toronto.

PECK CARRIERS FOR POWER PLANTS
Can. Link-Belt Co., Toronto, Ont.

PENSTOCKS
William Hamilton Co., Peterboro, Ont.

PERFORATED METALS AND ORNAMENTAL IRON GOODS
Canada Wire & Iron Goods Co., Hamilton

PHOSPHOR TIN, COPPER AND BRONZE
British Smelting & Refining Co., Ltd., Montreal, Que.

PHOTOSTATS
Commercial Camera Co., Providence, R.I.

PIG IRON
Hanna & Co., M. A., Cleveland, O.
Steel Co. of Canada, Ltd., Hamilton, Ont.

PINS, TAPER
Morrow Screw & Nut Co., J., Ingersoll, Ont

PINS, BELT-LACING
Clipper Belt Lacer Co., Grand Rapids.

PIPE, BLACK & GALVANIZED
Crane, Ltd., Montreal, Que.

PIPE FITTINGS, MALLEABLE AND CAST IRON
International Malleable Iron Co., Guelph.

PIPE CUTTING AND THREADING MACHINES
Barber Mchy. Co., Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Curtis & Curtis Co., Bridgeport, Conn.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield.
Hall & Sons, John H., Brantford.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
McDougall Co., R., Galt.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt, Ont.
Williams Tool Co., Erie, Pa.
Williams Machy. Co., A. R., Toronto.

PIPE, JOINT COMPOUNDS
Crane, Ltd., Moutreal, Que.

PIPE RIVETED STEEL
Toronto Iron Works, Ltd., Toronto.
William Hamilton Co., Peterboro, Ont.

PIERCING
Oliver Machy. Co., Grand Rapids, Mich.

PIPE CUTTERS, ROLLING
Curtis & Curtis Co., Bridgeport, Conn.
Greenfield Tap & Die Corp., Greenfield.
Hall & Sons, Ltd., John H., Brantford.
Wells Bros. Co. of Canada, Galt, Ont.

PIPE TOOLS AND DIES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE CUTTERS AND REAMERS
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE STOCKS AND THREADERS
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE TAPS AND VISES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE WRENCHES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PISTON AND PISTON RING MACHINES
National Acme Co., Windsor, Vt.

PLANER BOLTS
Atkins & Co., E. C., Hamilton, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont

PLANER JACKS
Armstrong Bros. Tool Co., Chicago.

PLANERS, STANDARD AND ROTARY
Betts Machine Co., Rochester, N.Y.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Oliver Machy. Co., Grand Rapids, Mich.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal
Gardner & Son, Robt., Montreal.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Morton Mfg. Co., Muskegon Heights, Mich
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.

PLANING AND SHAPING MACHINERY
Barber Mchy. Co., Ltd., Toronto, Ont
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
Niles-Bement-Pond Co., New York.
Ohio Mach. Tool Co., Kenton, Ohio.
Perrin, Ltd., William, Toronto.
Williams Mchy Co. Ltd., A. R., Montreal

PLANER-SHAPER, COMBINED OPEN SIDE
Lund-Farquhar Co., Boston.
Petrie, Ltd., H. W., Toronto.

POWER HAMMERS
Quickwork Co., St. Marys, Ohio.

PLANING MILL EXHAUSTERS
Can. Blower & Forge Co., Kitchener, Ont
MacGovern & Co., Montreal, Que.
Niles-Bement-Pond Co., New York.
Sturtevant Co., B. F., Galt, Ont.

PLATES, Q.M., SHEARED AND CHEQUERED
Pedlovers, Ltd., Toronto, Ont.

PLATING, PLANTS & SUPPLIES
Can. Hanson Van Winkle Co., Ltd., Toronto, Ont.

PLIERS
Aikenhead Hardware Co., Toronto.
Can. Billings & Spencer, Ltd., Welland.
Rice Lewis & Son, Toronto, Ont.

PNEUMATIC TOOLS
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland P'matic Tool Co., Can., Toronto.
Curtis Pneumatic Machy. Co., St. Louis.
Garlock-Walker Machy. Co., Toronto.
Int. Mach. & Supply Co., Ltd., Montreal.
Independent Pneumatic Tool Co., Chicago.

POWER CRANES, HAND
MacKinnon Steel Co., Sherbrooke, Que.

POLISHING MACHINES
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto.

POLISHING PLATES
Greenfield Tap & Die Corp., Greenfield.
Petrie, Ltd., H. W., Toronto.
Wells Bros. of Canada, Galt, Ont.

POLISHING PAPER
H. H. Barton & Son Co., Philadelphia.

POTS AND KETTLES, CAST STEEL
Elec. Steel & Metals, Welland, Ont.

POWER HOUSE CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

PORTABLE MACHINERY
Haskins & Co., R. G., Chicago, Ill.

POWER TRANSMISSION MCHY
Canadian Link-Belt Co., Ltd., Toronto,
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Petrie, Ltd., H. W., Toronto.

PRESSED STEEL PARTS
Gray Ball Bearing Co., Ltd., Toronto.

PRESSERS, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Metalwood Mfg. Co., Detroit, Mich.
Petrie, Ltd., H. W., Toronto.

PRESSES, BROACHING, FORGING AND FLANGING
Atlas Press Co., Kalamazoo, Mich.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Dom. Steel Products Co., Ltd., Brantford.
Metalwood Mfg. Co., Detroit, Mich
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
Stoll Co., D. H., Buffalo, N.Y.
Williams Mchy Co., Ltd., A. R., Montreal

PRESSES, CAM, TOGGLE, EYELET
Baird Machine Co., Bridgeport, Conn.
Bliss Co., E. W., Brooklyn, N.Y.
Toledo Machine & Tool Co., Toledo.
Stoll Co., D. H., Buffalo, N.Y.

PRESSES, FILTER
Perrin, Ltd., William R., Toronto.
Smalley-General Co., Inc., Bay City, Mich.

PRESSES, PNEUMATIC
Barber Mchy. Co., Ltd., Toronto, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Metalwood Mfg. Co., Detroit, Mich.
Toledo Machine & Tool Co., Toledo.

PRESSES, DROP AND FORGING
Barber Mchy. Co., Ltd., Toronto, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton.
Can. Fairbanks-Morse Co., Montreal.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co, Toledo.

PRESSES, HYDRAULIC
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Dom. Steel Products Co., Ltd., Brantford.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
Stoll Co., Inc., D. H., Buffalo, N.Y.
Williams Machy. Co., A. R., Toronto.

PRESSES, HYDRO-PNEUMATIC
Eastern Production Co., Detroit, Mich.

PRESSES, BALING
Perrin, Ltd., William R., Toronto.

PRESSES, POWER
Baird Machine Co., Bridgeport, Conn.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo.
Williams Machy. Co., A. R., Toronto.

PRESSES, SPRING FOOT
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Ont.
Toledo Machine & Tool Co., Toledo.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal

PRESSES, SCREW
Barnes & Co., W. F. & Jno., Rockford, Ill
Bliss Co., E. W., Brooklyn, N.Y.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.

PRESSES, TIRE
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,

PRESSES, TRIMMING
Bliss Co., E. W., Brooklyn, N.Y.
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.

PROJECTORS, FLOOD LIGHTING
Lyman Tube & Supply Co., Montreal, Que

PROPELLERS
Kennedy & Sons, Wm., Owen Sound.

PROTECTIVE COATINGS
H. H. Robertson, Ltd., Sarnia, Ont.

PSYCROMETERS, SLING
Taylor Instrument Co., Rochester, N.Y.

PULLEYS
Algoma Steel Corp., Sault Ste. Marie, Ont
American Pulley Co., Philadelphia.
Baird Machine Co., Bridgeport, Conn.
Bernard Industrial Co., Fortierville, Que.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Diamond State Fibre Co., Bridgeport, Pa.
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Kennedy & Sons, Ltd., W., Owen Sound.
Positive Clutch & Pulley Works Ltd., Toronto.
Petrie, Ltd., H. W., Toronto.

PULLEYS, STEEL SASH, STEEL BELT
American Pulley Co., Philadelphia, Pa.

PULLEYS, FRICTION, CLUTCH
American Pulley Co., Philadelphia, Pa.
Baird Machine Co., Bridgeport, Conn.
Bernard Industrial Co., A., Fortierville, Q.
Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mch. Co., Manchester, Ct.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Jones & Glassco, Montreal.
Positive Clutch & Pulley Works, Toronto.
Petrie, Ltd., H. W., Toronto.

PULP MILL MACHINERY
Can. Ingersoll-Rand Co., Ltd., Sherbrooke.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

PUMPS, AIR LIFT
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,

PUMPS, BOILER FEED
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,

PUMPS, CENTRIFUGAL
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Ingersoll-Rand Co., Montreal, Que.
Darling Bros., Ltd., Montreal, Que.
Hamilton Co., Ltd., Wm., Peterborough, Ont.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

PUMPS, FUEL OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Darling Bros., Ltd., Montreal, Que.
Trahern Pump Co., Rockford, Ill.

PUMPS, GEARED
Darling Bros., Ltd., Montreal, Que.
Globe Engineering Co., Hamilton, Ont.

PUMPS, HIGH PRESSURE
Perrin, Ltd., William R., Toronto.

PUMPS, HYDRAULIC
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Clarke & Co., Furniss, Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Darling Bros., Ltd., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
Metalwood Mfg. Co., Detroit, Mich.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

PUMPS, LUBRICATING, OIL STORAGE
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, RETURN AIR
Can. Ingersoll-Rand Co. Ltd., Sherbrooke,

PUMPS, SPECIAL
Elec. Steel & Metals, Welland, Ont.

PUMPS, RUBBER CEMENT
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, KEROSENE, OIL, SELF-MEASURING
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, LUBRICANT, OIL, WATER
Darling Bros., Ltd., Montreal, Que.
Trahern Pump Co., Rockford, Ill.

PUMPS — ROTARY
General Combustion Co., Ltd., Montreal, Que.

PUMP LEATHERS
Graton & Knight Mfg. Co., Worcester.

PUNCHES AND DIES
Atkins & Co., Ltd., Wm., Sheffield, Eng.
E. W. Bliss Co, Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Can.
Can. Blower & Forge Co., Kitchener, Ont.
Crescent Mach. Co., Ltd., Montreal, P.Q.
Can. Fairbanks-Morse Co., Montreal.
Elliott & Whitehall Machine and Tool Co., Galt, Ont.
Gardner & Son, Robert, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Marshall, Son & Blunney, Toronto.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Williams Mchy Co., A. R., Toronto, Ont.

PUNCHES, POWER
John Bertram & Sons Co., Dundas, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd, Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd. Brantford.
Garlock-Walker Machinery Co., Toronto.
A. B. Jardine & Co., Hespeler, Ont.
Long & Allstatter, Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
D. H. Stoll Co., Buffalo, N.Y.
Williams Mchy Co., A. R., Toronto, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertrams, Ltd., Edinburgh, Scotland.
Bertrams & Sons, John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton, Ont.
Garlock-Walker Mach'y. Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

PYROMETERS
Bristol Co., Waterbury, Conn.
Shore Instrument & Mfg. Co., New York
Taylor Instrument Co., Rochester, N.Y.

QUARTERING MACHINES
Bertram & Sons, John, Dundas, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Niles-Bement-Pond Co., New York.

QUARRY HOISTS
Canadian Mead-Morrison Co., Limited, Montreal, Que.

RAIL BENDERS
Algoma Steel Corp., Sault Ste. Marie, O.

PUNCHES, HAND
Niles-Bement-Pond Co., New York.

RAILROAD TOOLS
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

RASPS
Atkins & Co., Ltd., Wm., Sheffield, Eng
Marshall, Son & Bunney, Toronto.

RAWHIDE PINIONS (See Gears)

REAMERS
Butterfield & Co., Inc., Rock Island, Que.

REAMERS, ADJUSTABLE
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Elliott & Whitehall Machine and Tool Co., Galt, Ont.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Machy. Co., Ingersoll, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Plewes, Ltd., Winnipeg, Man.
Pratt & Whitney Co., Dundas, Ont.
The Kelly Reamer Co., Cleveland, O.
J. A. M. Taylor, 318 Stair Bldg., Toronto.
Wells Bros. of Can., Galt, Ont

REAMERS, BRIDGE, EXPANDING AND HIGH SPEED
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Aikenhead Hardware Co., Toronto.
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Elliott & Whitehall Machine and Tool Co., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Lyman Tube & Supply Co., Montreal, Que
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
Samuel Osborne, Ltd., Montreal, P.Q.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, STEEL TAPER AND SELF-FEEDING
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, CHUCKING
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Elliott & Whitehall Machine and Tool Co., Galt, Ont.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Machy. Co., Ingersoll, Ont.
Marshall, Son & Bunney, Toronto.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wells Bros. of Canada, Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, HAND
Butterfield & Co., Inc., Rock Island, Que.
Elliott & Whitehall, Galt, Ont.
Greenfield Tap & Die Corp., Greenfield.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wells Bros. of Can., Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, PIN
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Morrow Screw & Nut Co., John, Ingersoll.
Wells Bros. of Can., Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMER FLUTING MACHINES
Garvin Machine Co., New York..

REAMING MACHINES, PNEUMATIC
Cleveland Pneumatic Co. of Can., Toronto
Garlock-Walker Machinery Co., Toronto.

RECORDING INTRUMENTS
Bristol Co., Waterbury, Conn.
Gisholt Machine Co., Madison, Wis.
Taylor Instrument Co., Rochester, N.Y.

REELS, WIRE AND TEXTILE MFG.
American Pulley Co., Philadelphia, Pa.

REGULATORS, AUTOMATIC
Electric Steels & Metals, Ltd., Welland.

REGULATORS, PRESSURE, TEMPERATURE
Can. Fairbanks-Morse Co., Montreal.
Taylor Instrument Co., Rochester, N.Y.

REPAIR WORK — SAWS
Atkins & Co., E. C., Hamilton, Ont.

REPAIR WORK, ALL KINDS
Elec. Steel & Metals, Welland, Ont.

RIVETS,
Aikenhead Hardware Co., Toronto, Ont.
Parmenter & Bulloch Co., Gananoque.
Rice, Lewis & Son, Toronto.
Steel Co. of Canada, Ltd., Hamilton.

RIVETERS, PNEUMATIC, HYDRAULIC, HAMMER, COMPRESSION
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Montreal.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.

RIVETING MACHINES, ELASTIC, ROTARY BLOW
Grant Mfg. & Machine Co., Bridgeport.
High-Speed Hammer Co., Rochester.
Petrie, Ltd., H. W., Toronto.
F. B. Shuster Co., New Haven, Conn.

ROAD BUILDING EQUIPMENT
Can. Ingersoll-Rand Co., Ltd., Sherbrooke.

ROAD-MAKING MACHINERY
G. F. Foss Mchy & Sply. Co., Montreal.

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Garlock-Walker Machinery Co., Toronto
Niles-Bement-Pond Co., New York.
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Toledo Machine & Tool Co., Toledo, O.

ROLLS CRUSHING
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

ROLLS AND TABLES
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Elec. Steel & Metals, Welland, Ont.

ROOFING
H. H. Robertson, Ltd., Sarnia, Ont.

ROPE, GALV., MONEL METAL, BRONZE, TILLER AND SASH CORD
Can. Driver-Harris Co., Ltd., Walkerville.

ROTARY SHEARS
The Quickwork Co., St. Mary's, Ohio.

ROOF COOLERS
Electric Steels & Metals, Ltd., Welland

ROLLING MACHINES, SHEET METAL
Manhattan Machine & Tool Co., Grand Rapids, Mich.

ROLLING MILL MACHINERY
Dom. Steel Products Co., Ltd., Brantford
Mesta Machine Co., Pittsburgh, Pa.

ROLL LATHES
Mesta Machine Co., Pittsburgh, Pa.

ROLLS, BENDING, STRAIGHTENING
Manhattan Machine & Tool Co., Grand Rapids, Mich.

ROLLS, CRUSHING
Can. Link-Belt Co., Toronto.

RUBBER MOULDS AND CORES
Elliott & Whitehall, Galt, Ont.

RUBBER MILL DRIVES
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dom. Steel Products Co., Ltd., Brantford
Can. Link-Belt Co., Toronto.

RUBBER MILL MACHINERY
Bertrams Ltd., Edinburgh, Scotland.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dom. Steel Products Co., Ltd., Brantford.

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Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

RUBBER PRODUCTS, MECHANICAL
Dunlop Tire & Rubber Goods Co., Ltd., Montreal.

RUBBING BRICKS
Dominion Abrasive Co., Mimico, Ont.

RULES
Brown & Sharpe Mfg. Co., Providence.
James Chesterman & Co., Ltd., Sheffield.
Rice, Lewis & Son, Toronto.
L. S. Starrett Co., Athol, Mass.

RULES, STEEL, STRAIGHT, AND FOLDING
Lufkin Rule Co. of Can., Windsor.

RULES, BOXWOOD, FOLDING
Lufkin Rule Co. of Can., Windsor.

RULES, BOARD AND LONG
Lufkin Rule Co. of Can., Windsor.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N.Y.

SAW MILL CONVEYORS
Can. Link-Belt Co., Toronto.
Petrie, Ltd., H. W., Toronto.

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Frost Mfg. Co., Chicago, Ill.

SAND-BLAST EQUIPMENT SAND BLAST SUPPLIES AND ACCESSORIES
Pangborn Corporation, Hagerstown, Md.

SAND BLAST ABRASIVES
Pangborn Corporation, Hagerstown, Md.

SAND MIXING MACHINERY
Frost Mfg. Co., Chicago, Ill.

SANITARY DRINKING FOUNTAINS
Puro Sanitary Drinking Fountain Co., Haydenville.

SANDING MACHINES
Canada Machinery Corp., Galt.

SAW MILL MACHINERY
Can. Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt.
Robert Gardner & Son, Montreal.
Curtis Pneumatic Machy Co., St. Louis
Hamilton Co., Ltd., Wm., Peterborough, Ont.
A. R. Williams Machy. Co., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

SASH SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

SAWS FOR EVERY USE
Atkins & Co., E. C., Hamilton, Ont.

SAWS, CIRCULAR METAL
Atkins & Co., E. C., Hamilton, Ont.
Wm. Atkins & Co., Ltd., Sheffield, Eng.
Marshal, Son & Bunney, Toronto.
Plewes Ltd., Winnipeg, Man.
Simonds Mfg. Co., Fitchburgh, Mass.
Tabor Mfg. Co., Philadelphia, Pa.

SAWS, HACK (See Hack Saws)

SAW GUARDS
Atkins & Co., E. C., Hamilton, Ont.

SAWS, METAL, HACK AND BAND
Atkins & Co., E. C., Hamilton, Ont.

SAWS, SILVER STEEL
E. C. Atkins & Co., Inc., Indianapolis.

SAW SHARPENERS
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Can., Galt, Ont.

SAWS, SLITTING
J. A. M. Taylor, Stair Bldg., Toronto.
Atkins & Co., E. C., Hamilton, Ont.
Elliott & Whitehall Machine and Tool Co., Galt, Ont.

SAWS — HIGH-SPEED FRICTION
Atkins & Co., E. C., Hamilton, Ont.

SAWS — PATTERN SHOP
Atkins & Co., E. C., Hamilton, Ont.

SAWS — SWING
Atkins & Co., E. C., Hamilton, Ont.

SCALES
Can. Kron Scale Co., Montreal, P.Q.

SCALES, MECHANICS'
Lufkin Rule Co. of Can., Windsor.

SCLEROSCOPES
Shore Instrument & Mfg. Co., New York.

SCREENING MACHINERY
Can. Link-Belt Co., Toronto.

SCREW EXTRACTORS
Cleveland Twist Drill Co., Cleveland.

SCREW MACHINES, HAND, AUTOMATIC
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Ltd., Toronto
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield.
A. B. Jardine & Co., Hespeler.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Warner & Swasey Co., Cleveland, O.
Wells Bros. of Can., Galt, Ont.
Wood Turret Mach. Co., Brazil, Ind.

SCREWS, MACHINE, SET, CAP AND SPECIAL
Galt Machine Screw Co., Galt.
John Morrow Screw & Nut Co., Ingersoll.
National Acme Co., Montreal.
Rice Lewis & Son, Toronto.
Steel Co. of Canada, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.

SCREW COLLARS
Galt Machine Screw Co., Ltd., Galt, Ont.
John Morrow Screw & Nut Co., Ingersoll.

SCREW MACHINES, PLAIN WIRE FEED
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.

SCREW PLATES
Butterfield & Co., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
A. B. Jardine & Co., Hespeler.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto.
J. A. M. Taylor, Stair Bldg., Toronto.
Wells Bros. of Can., Galt.
Wilkinson & Kompass, Hamilton.

SCREWS, SAFETY SET
Galt Machine Screw Co., Ltd., Galt, Ont.

SCREW SLOTTERS
Butterfield & Co., Inc., Rock Island, Que.
Garvin Machine Co., New York.
National Acme Co., Cleveland, O.
Pratt & Whitney Co., Dundas, Ont.

SEPARATORS, MOISTENERS AND OIL FOR COMPRESSED AIR
Pangborn Corporation, Hagerstown, Md.

SELF-OPENING DIES
See Dies.

SEPARATORS, SAND
Pangborn Corporation, Hagerstown, Md.

SET SCREWS, SAFETY
Aikenhead Hardware Co., Toronto.
Bristol Co., Waterbury, Conn.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wilkinson & Kompass, Hamilton.

SHANKS, STRAIGHT AND TAPER
Jacobs Mfg. Co., Hartford, Conn.

SHAPERS
Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons Co., Dundas.
Can. Fairbanks-Morse Co., Montreal.
Canadian Machinery Corp., Galt.
Geo. F. Foss Mchy. & Sply. Co., Montreal
Robt. Gardner & Son, Montreal.
Garlock-Walker Mach'y. Co., Toronto.
Hendey Machine Co., Torrington, Conn.
Milwaukee Shaper Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto.
Rae Mach. Tool Co., Hamilton.
Standard Equipment & Tool Wks., Montreal.
Walcott Lathe Co., Jackson, Mich.
Williams Mchy Co., A. R., Toronto, Ont.

SHAPERS, GEAR
Fellows Gear & Shaper Co., Springfield, V
Knight Metal Products, Toronto.

SHAFTING
Algoma Steel Corp., Sault Ste. Marie, O.
Can. Fairbanks-Morse Co., Montreal.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Jones & Glassco, Montreal.
Niles-Bement-Pond Co., New York.
Can. Drawn Steel Co., Hamilton.
Peckovers, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas.
Rice, Lewis & Son, Toronto.
A. R. Williams Machy. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

SHARPENING STONES
Norton Co., Worcester, Mass.
Rice, Lewis & Son, Toronto.

SHEARING MACHINES, ANGLE IRON, BAR AND GATE
John Bertram & Sons Co., Dundas.
Bertrams Ltd., Edinburgh, Scotland.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
A. B. Jardine & Co., Hespeler, Ont.
Long & Allstatter Co., Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo, O.

SHEARS, POWER
John Bertram & Sons Co., Dundas.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton.
Can Blower & Forge Co, Kitchener.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Long & Allstatter, Hamilton, Ohio.
A. B. Jardine & Co., Hespeler, Ont.
National Machy. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
H. D. Stoll Co., Inc., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Williams, White & Co., Moline, Ill.
Williams Mchy Co., A. R., Toronto, Ont.

SHEARS, ROTARY
The Quickwork Co., St Mary's, Ohio.

SHEARS, PNEUMATIC
Toledo Machine & Tool Co., Toledo, Ohio

SHEARS, PLATE CUTTING, SLITTING
Dom. Steel Products Co., Ltd., Brantford.
Quickwork Co., St. Mary's, Ohio.

SHEARS, SPLITTING
Dom. Steel Products Co., Ltd., Brantford.

SHEARS, IRREGULAR AND CIRCLE CUTTING
The Quickwork Co., St. Mary's, Ohio.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEARS, SERPENTINE
The Quickwork Co., St. Mary's, Ohio.

SHEARS, SQUARING
Brown, Boggs & Co., Hamilton, Ont.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEET METAL WORKING MACHINERY
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEET METAL WORKING TOOLS
Baird Machine Co., Bridgeport, Conn.
Barber Mchy. Co., Ltd., Toronto, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton.
Peck, Stow & Wilcox Co., Southington, C.
Petrie, Ltd., H. W., Toronto.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEETS, CRUCIBLE, CAST
British Smelting & Refining Co., Ltd., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.

SHEETS, BLACK AUTO AND GALVANIZED
Peckovers, Ltd., Toronto, Ont.

SHEETS, NICKEL, RESIST, ALLOY
Can. Driver-Harris Co., Ltd., Walkerville.

SHELVING, STEEL
Dennis Wire & Iron Works, London.

SHIPYARD MACHINERY, SHOP FURNITURE
Dennis Wire & Iron Works, London.

SIDE TOOLS
Armstrong Bros. Tool Co., Chicago.
J. H. Williams & Co., Brooklyn, N.Y.

SILENT CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.

SLEDGES
Aikenhead Hardware Co., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.

SLEDGES, CAST IRON
Katie Foundry, Galt, Ont.

SLICING CLAMPS
Peck, Stow & Wilcox Co., Southington Conn.

SLINGS, CHAINS
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

SLOTTERS
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
National-Acme Co., Cleveland, Ohio.
Niles-Bement-Pond Co., New York.

SMOKESTACKS
William Hamilton Co., Peterboro, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

SNIPS, TINNERS AND SHEET METAL WORKERS
Kearney & Trecker Co., Milwaukee, Wis.
J. Morrow Screw & Nut Co., Ingersoll, Ont.

SOCKETS
Brown & Sharpe Mfg. Co., Providence.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Keystone Mfg. Co., Buffalo, N.Y.
Modern Tool Co., Erie, Pa.
J. Morrow Screw & Nut Co., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

SOIL PIPE FITTINGS, CAST IRON
Katie Foundry, Galt, Ont.

SOLDERING IRONS
Aikenhead Hardware Co., Toronto, Ont.
Brown, Boggs & Co., Hamilton, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.

SOLDER
British Smelting & Refining Co., Ltd., Montreal, Que.
Aikenhead Hardware Co., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Tallman Brass & Metal Co., Hamilton.

SPELTER
British Smelting & Refining Co., Ltd., Montreal, Que.

SPEED REDUCING GEARS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.

SPRINGS, MACHINERY
Barnes, Wallace Co., Bristol, Conn.
Can. Steel Foundries, Ltd., Montreal.
Cleveland Wire Spring Co., Cleveland.
Dunbar Bros. Co., Bristol, Conn.
Garlock-Walker Machinery Co., Toronto.

SPECIAL MACHINERY
Baird Machine Co., Bridgeport, Conn.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram, John, & Sons Co., Dundas.
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada.
Brown Engineering Corp., Toronto, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Globe Engineering Co., Ltd., Hamilton.
John H. Hall & Sons, Brantford.
Hamilton Co., Ltd., Wm., Peterborough.
A. B. Jardine & Co., Hespeler, Ont.
Katie Foundry, Galt, Ont.
Ker & Goodwin Machine Co., Ltd., Brantford, Ont.
McCrosky Tool Corp., Meadville, Pa., U. S. A.
National-Acme Co., Cleveland, Ohio.
Mesta Machine Co., Pittsburgh, Pa.
Rae Mach. Tool Co., Hamilton.
Stoll Co., D. H., Buffalo, N.Y.
Victoria Foundry Co., Ottawa, Ont.
William R. Perrin, Ltd., Toronto.

SPECIAL TOOLS, MACHINERY
Crescent Machine Co., Ltd., Montreal, Que.
McClean Machine & Tool Co., Ltd., Hamilton, Ont.
Hoggson & Pettis Mfg. Co., New Haven Conn.

SPOT FACERS, INTERCHANGEABLE
Eclipse Counterbore Co., Ltd., Walkerville, Ont.

SPRING COILING AND WINDING MACHINERY
Baird Machine Co., Bridgeport, Conn.
Garvin Machine Co., New York.

SPRING MAKING MACHINERY (AUTOMATIC)
Baird Machine Co., Bridgeport, Conn.

SPRINGS, SPIRAL, TOOL
The Dunbar Bros. Co., Bristol, Conn.

SPRINGS STEEL
Barnes Co., Wallace, Bristol, Conn.

SPROCKETS, COMPENSATING
Morse Chain Co., Ithaca, New York.

SPROCKETS, SPRING
Morse Chain Co., Ithaca, New York.

SPROCKETS, CHAIN
Can Link-Belt Co., Toronto, Ont.
Grant Gear Works, Boston, Mass.
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia.

SPRINGS FOR TOYS AND ELECTRIC DEVICES
The Dunbar Bros. Co., Bristol, Conn.

SPROCKET WHEELS, CAST
Can. Link Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Ltd., Montreal

SAFETY CYLINDERS
Oliver Mach. Co., Grand Rapids, Mich.

SANDERS
Oliver Mach. Co., Grand Rapids, Mich.

SAW BENCHES
Oliver Mach. Co., Grand Rapids, Mich.

SAW GUARDS
Oliver Mach. Co., Grand Rapids, Mich.

SAWS SWING
Oliver Mach. Co., Grand Rapids, Mich.

STAYBOLT TOPS
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

STAIRS, IRON
Canada Wire & Iron Goods Co., Hamilton, Ont.

STAMPINGS, SHEET BRASS, COPPER, ALUMINUM AND STEEL
Dom. Forge & Stamping Co., Walkerville
Globe Engineering Co., Hamilton, Ont.
Homer & Wilson, Hamilton, Ont.

STAMPING MACHINERY
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs, & Co., Hamilton, Can.
Canada Machinery Corp., Galt, Ont.
Matthews, Jas. H. & Co., Hartford, Conn.

SAFETY CYLINDERS
Oliver Mach. Co., Grand Rapids, Mich.

STEAM APPLIANCES
Darling Bros., Ltd., Montreal, Quebec.

STEAM SEPARATORS AND TRAPS
Can. Fairbanks-Morse Co., Montreal.

STEAM HOISTING ENGINES
Canadian Mead-Morrison Co., Limited, Montreal, Que.

STEAM TURBINES
General Combustion Co., Ltd., Montreal, Que.
Sturtevant Co., B. F., Galt, Ont.

STEEL BALLS
See Balls Steel.

STEEL, CRUCIBLE TOOL
Atkins & Co., Ltd., Wm. Sheffield, Eng.
Baines & David, Toronto.
Illingworth Steel Co., John, New York.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.

STEEL, CARBON, FERRO-TUNGSTEN
Armstrong, Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Baines & David, Toronto.
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Latrobe Electric Steel Co., Latrobe, Pa.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
Marshall, Son & Bunney, Toronto.
Peckovers, Ltd., Toronto, Ont.
Samuel Osborne (Can.), Ltd., Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL, CHROME MOLYBDENUM
United States Steel Corp., Canton, Ohio.

STEEL CHROME VANADIUM
Kayser-Ellison & Co., Ltd., Montreal.
Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm. Sheffield, Eng.
Marshall, Son & Bunney, Toronto.
United States Steel Corp., Canton, Ohio.

STEEL CHROME NICKEL
Firth & Sons, Ltd., Thos., Montreal.
Kayser-Ellison & Co., Ltd., Montreal.
Lyman Tube & Supply Co., Ltd., Montreal
Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.
United States Steel Corp., Canton, Ohio.

STEEL CASTINGS
Can. Elec. Steel Casting Co., Aurora, Ont.
Davidson Mfg. Co., Ltd., Montreal, Que.
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Dom. Iron & Steel, Sydney, N.S.
Joliette Steel Co., Montreal, Que.
Kennedy & Sons, Wm., Owen Sound.
Electric Steel & Metals Co., Welland.
Nova Scotia Steel & Coal Co., Windsor.
Swedish Crucible Steel Co., Windsor.

STEEL, COLD DRAWN
United States Steel Corp., Canton, Ohio.

STEEL, COLD ROLLED
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Drawn Steel Co., Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co. Ltd., Montreal.
Union Drawn Steel Co., Hamilton, Ont.

STEEL, ELECTRIC FURNACE
United States Steel Corp., Canton, Ohio.

STEEL FJAB
Lincoln Electric Co., of Canada, Ltd., Toronto, Ont.

STEEL, NICKEL
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
United States Steel Corp., Canton, Ohio.

STEEL, HIGH SPEED
Armstrong-Whitworth of Can., Montreal.
Baines & David, Toronto.
Wm. Atkins & Co., Sheffield, Eng.
Can. Fairbanks-Morse Co., Montreal.
Deloro Smelting & Refining Co., Ltd. Toronto, Ont.
H. A. Drury Co., Ltd., Montreal.
Firth & Sons, Thos., Montreal, Que.
Illingworth Steel Co., J., New York.
Kayser Ellison & Co., Sheffield, Eng.
Latrobe Electric Steel Co., Latrobe, Pa.
Marshall, Son & Bunney, Toronto, Ont.
Osborne, Samuel, Montreal, P.Q.
Plewes, Ltd., Winnipeg, Man.
Pilot Steel & Tool Co., Montreal, Que.
Ralph B. Norton, Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co., Ltd., Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL, CHROME, MANGANESE
Joliette Steel Co., Montreal, Que.

STEEL, OPEN HEARTH
Illingworth Steel Co., John, New York.
United States Steel Corp., Canton, Ohio.

STEEL PLATES
Dominion Foundries & Steel Ltd., Hamilton, Ont.

STEEL PRODUCTS AND MACHINERY
Dom. Steel Products Co., Ltd., Brantford

STEEL, ROCK DRILL
Armstrong, Whitworth of Canada, Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.

STEEL, SPECIAL ANALYSIS
United States Steel Corp., Canton, Ohio.

STEEL, SPRING AND REINFORCING
Peckovers, Ltd., Toronto, Ont.
United States Steel Corp., Canton, Ohio.

STEEL, STRUCTURAL
Algoma Steel Corp., Sault Ste. Marie
Dom. Iron & Steel Co., Sydney, N.S.
MacKinnon Steel Co., Sherbrooke, Que.
Peckovers, Ltd., Toronto, Ont.

STEEL, TOOL
Armstrong, Whitworth of Can., Montreal.
Atkins & Co., Wm., Sheffield, Eng.
Baines & David, Toronto.
Can. Fairbanks-Morse Co., Montreal.
Drury Co., H. A., Montreal, Que.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.
Firth & Sons, Thos., Montreal, Que.
Hawkridge Bros. Co., Boston, Mass.
Kayser-Ellison & Co., Ltd., Montreal.
Lincoln Electric Co., of Canada, Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Ltd., Montreal
Marshall, Son & Bunney, Toronto, Ont.
Latrobe Electric Steel Co., Latrobe, Pa.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son Toronto, Ont.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL TUBING
Tube Co. of Canada, Ltd., Toronto, Ont.

STEEL, VANADIUM
Wm. Atkins & Co., Ltd., Sheffield, Eng.
Armstrong, Whitworth of Can., Montreal.
Dominion Foundries & Steel Ltd., Hamilton, Ont.
Drury, H. A., Co., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.
Wells Bros. of Can., Galt, Ont.

"STELLITE"
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.

STOCK RACKS FOR BARS, PIPING, ETC.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

STOCKS AND DIES
Butterfield & Co. Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros., of Can., Galt, Ont.

STOCKS, PIPE
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros., Co., of Canada, Galt, Ont.

STONES, COMMUTATORS
Lyman Tube & Supply Co., Ltd., Montreal

STRAIGHTENING MACHINERY
Baird Machinery Co., Bridgeport, Conn.
Bertrams, Ltd., Edinburgh, Scotland.

STRAND
Dom. Steel Products Co., Ltd., Brantford.
Page Steel & Wire Co., Adrian, Mich.

SURFACE PLATES
Brown & Sharpe Mfg. Co., Providence, R.I.

STRUCTURAL STEEL WORKS
William Hamilton Co., Peterboro, Ont.

SWITCHBOARDS
Northern Electric Co., Ltd., Montreal Que

SWITCHES, RAILWAY
Can. Steel Foundries, Ltd., Montreal.

TABLES, DRAWING
Economy Drawing Table Co., Adrian, Mich.

TABLES, SAND-BLAST
Pangborn Corporation, Hagerstown, Md.

TAPPING MACHINES (PNEUMATIC)
Cleveland Pneumatic Tool Co., Toronto.

TANKS, AIR, EXPANSION
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, GASOLINE, KEROSENE AND OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. John Wood Mfg. Co., Ltd., Toronto
Dominion Bridge Co., Montreal, Que.
Dom. Forge & Stamping Co., Walkerville.
MacKinnon Steel Co., Sherbrooke, Que.
Marshall, Son & Bunney, Toronto.

TANKS, LEAD LINED
Can. Hanson Van Winkle Co., Ltd.,

TANKS, LUBRICATING, OIL STORAGE
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Can. John Wood Mfg. Co., Ltd., Toronto

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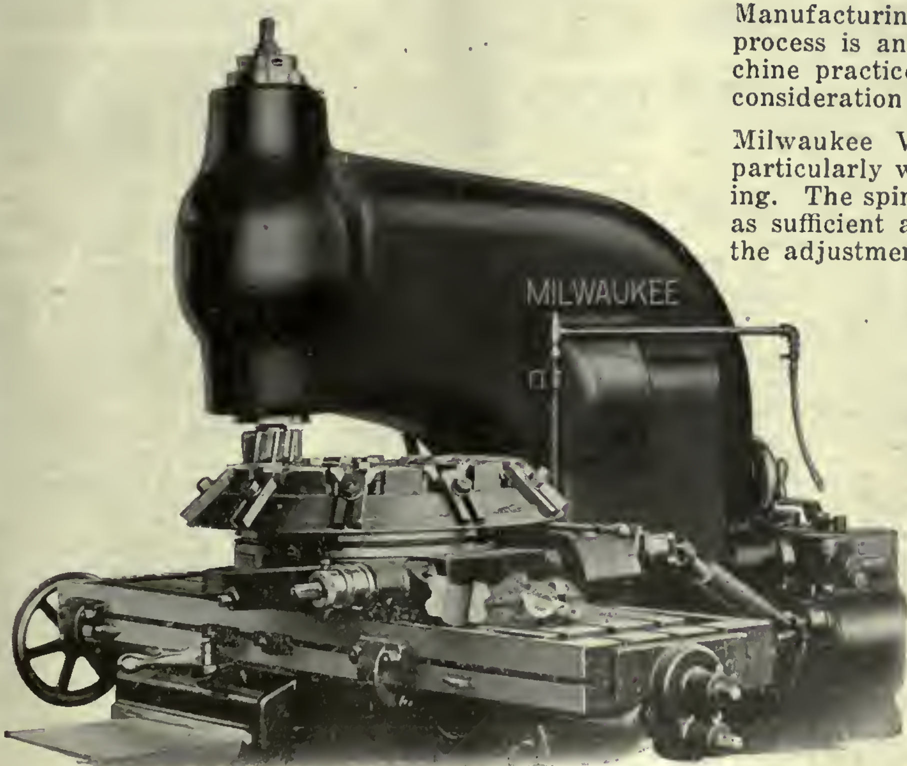

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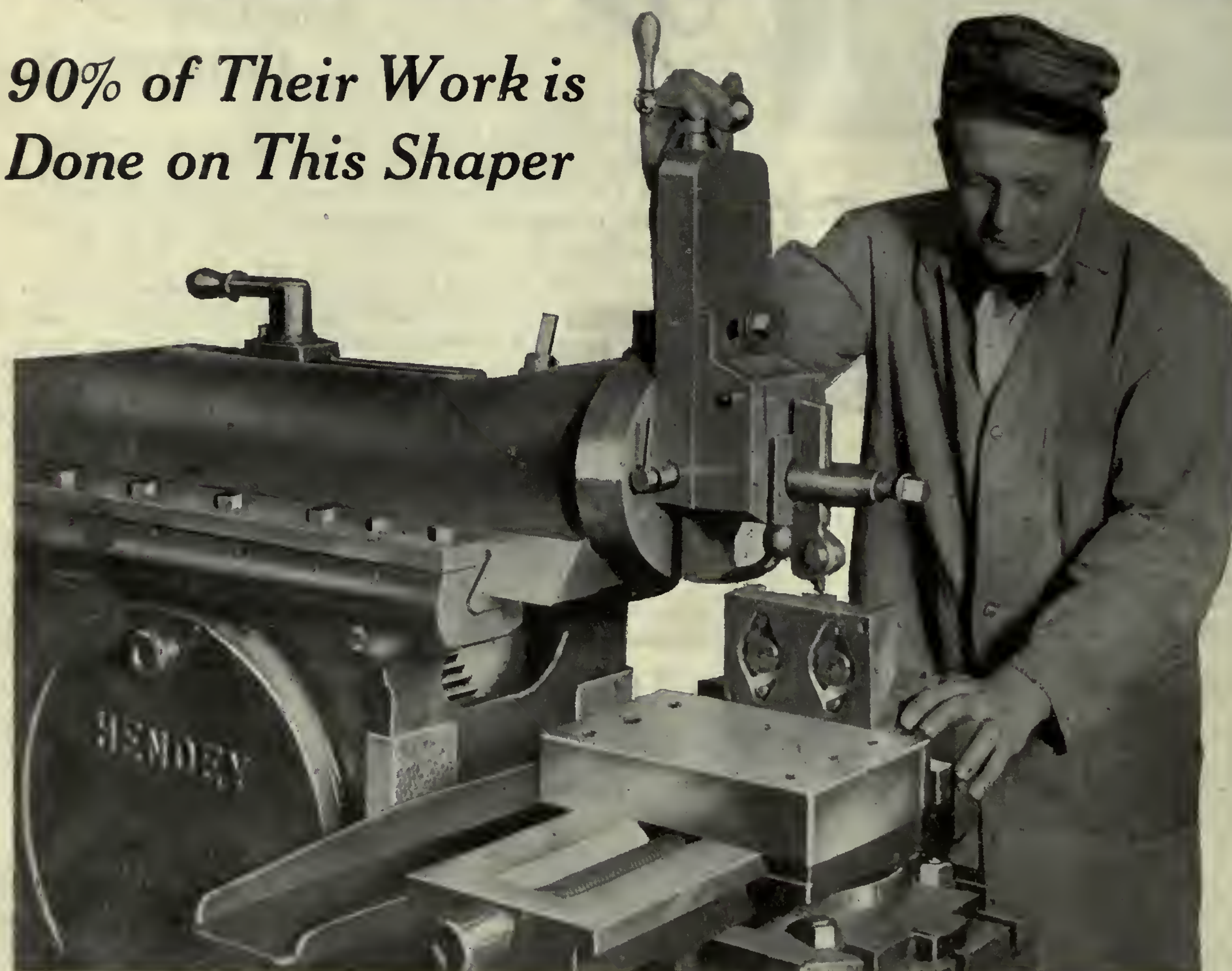

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This Machine is our 20-inch Crank Shaper

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